JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXVI., No. 2526.——TUESDAY, OCTOBER 10, 1911.

EDITORIAL NOTES—GAS, &c.

Coal-Liming Experiences at Cheltenham.

IT must be admitted that it is the duty of gas suppliers to distribute their commodity in as pure a state as is reasonable and practicable; but it must also be conceded that it is the duty of gas suppliers, in enhancing the purity of their gas, not to create a nuisance. After the abolition of the sulphur clauses (excepting in the few cases where the undertakings concerned did not, for various reasons best known to themselves, move in the matter), several gas undertakings found—depending, of course, upon the quality of the coal that was being used—the grains of sulphur compounds rise to an amount per 100 cubic feet that was not compatible with their circumstances and interests; and therefore there has, within our knowledge, in more cases than one or two, been a partial return to the old form of lime purification. But where that is so, it must only be taken to be merely a temporary expedient until another system is discovered that is free from the objectionable noxious accompaniments of the lime-purifier. Efforts are being made to obtain permanent relief both from any excessive number of grains of sulphur compounds, and from the nuisance and worry created by the disposal of spent lime. One direction in which such efforts have been made, and the satisfactory results bear the seal of about seventeen months' experience, is Cheltenham.

Following the discarding of lime purification, as the result of his emancipation from the sulphur clauses, Mr. R. O. Paterson was confronted with trouble in the nature of complaints. We all know Cheltenham; and we realize that discontent would not for long remain dormant there. That there was a difference in the gas supplied to them was soon the conviction—on the combustion of the gas—of some of the residents in the town. But Mr. Paterson, while desirous of mending such a situation, was equally determined not to return to the old order of lime purification, if it could possibly be avoided, that had given him and his staff so much trouble in former days. As our readers are aware, he picked up the question of the liming of coal for gas manufacture where the investigators had left it about a quarter of a century ago; and, with one of his assistants (Mr. L. E. Twycross), he sought to find out where there had been failure. As our readers are aware, to cut the story short, it was believed that the whole secret of the want of success of coal-liming in the past was to be found in the absence of any systematic application whereby the coal was equally treated with lime before entering the retorts. A system was accordingly developed, with the necessary apparatus, for ensuring this treatment; and some notion of the method and apparatus has already been obtained from our columns by the technical men of the industry. But to-day we are able, in a special article in other columns, to supplement the information previously published, and to give data and definite statements regarding both the working and the experiences. As is said in the article, it is believed, on the evidence of hard facts, that Cheltenham has produced a system for dealing with the sulphur compounds that is both economic and efficient in its benefits. Both economy and efficiency are disclosed in the achievement of the predominating object, to the extent of a 40 to 50 per cent. reduction of the sulphur compounds (making them a little above 20 grains per 100 cubic feet), at a cost of a shade above ¼d. per 1000 cubic feet of gas made. The end sought has been reached at a low cost.

These are not the sum of the advantages; and all the additional ones may be classed as economic. With coal-liming, there has been a cessation of stopped ascension-pipes, and less deposit of carbon in the retorts. The discontinuance of the trouble from stopped pipes means less labour; and, moreover, clear ascension-pipes have enabled the retort temperatures to be raised, without a recurrence of the trouble, with the further result that the make of gas last half year, per ton of coal carbonized, was as high as 13,407 cubic feet with blocked retorts and manual machinery—that is to say, it advanced by 845 feet per ton of coal. There are many other points discussed in the article elsewhere, and many details produced as to experience—all of which make interesting reading, and will suggest to the scientific investigator that there are various causes as to effects requiring elucidation before knowledge of this matter can be said to be complete. But those two or three main points to which reference has been made here stand out as hard facts established by a long and not ephemeral experience. Our special article to-day is not deeply scientific, nor does it deal with hypotheses. But its points are eminently practical, and, for that reason alone, it will appeal to many technical officers responsible for advising their Boards or Committees as to the course they should take under certain circumstances, such as Cheltenham and other places have experienced—remembering always that purity of one's staple commodity, as far as is reasonable and practicable, is an essential condition to the maintenance of satisfactory and good business relations.

Joint Standard Burner Bill Promotion.

SOME time since, it was mentioned in the "JOURNAL," that there was a probability of another Joint Standard Burner Bill being promoted in the next session of Parliament. The preliminary steps in the matter have been taken by the holding in London, on Thursday last, of a conference of representatives of certain Gas Companies who are disposed to take part in parliamentary action to secure as their standard the "Metropolitan" No. 2 burner, and so bring themselves into line with that imposing section of the industry whose gas is now tested by it. It is not now too much to say that the burner that is applied as the standard to the greater proportion of the town gas sold in this country to-day—not numbers of undertakings, but gas sold—is the "Metropolitan" No. 2; and Parliament has over and over again, session after session, endorsed the action of gas undertakings in asking for the power to use the new burner. The Gas Companies' Protection Association having done their part, and a good part, in paving the way for further parliamentary applications by what they did in 1910 (in fact, it may fairly be taken that they then finally disposed of any further difficulty in this matter), it is for those companies who now desire to take advantage of the accomplished pioneer work, to themselves initiate steps to secure the burner.

Something like twenty companies have so far expressed interest in the matter; and a number of them were represented at the preliminary conference last Thursday. On the occasion, a resolution was provisionally passed that a Joint Bill should be promoted; and Messrs. R. W. Cooper and Sons were requested to take the necessary measures for making the movement known. We do not think the question of expense is one that need be seriously considered. The new burner is one that a progressive policy demands should replace those of antiquated and now statutorily abandoned type. It seems beyond the bounds of possibility that there can be any local authorities who will, after the experience of the opposing local authorities in 1910 (who not only failed to convince Parliament that they had any satisfactory case, but inflicted upon themselves a burden that surprised some of them), venture to offer resistance to the burner on this occasion. A joint promotion anyway would be a less costly matter than approaching Parliament individually for this one express purpose; and there must be numbers of companies who have nothing else to apply to Parliament for at the present time. Under such circumstances, the view of the Parliamentary Agents, as expressed at the conference, was that between £600 and £700 (with about £40 additional for every company over and above seven) would meet the expense. With regard to its apportionment, it was suggested that each participating company should pay an initial sum of £21, and that the balance should be apportioned, at a subsequent

conference, on some such basis as the several companies' annual makes.

The second conference will be held shortly; and as time is advancing towards the date when the first step will have to be taken under the Standing Orders applying to Private Bill Legislation, there should be communication as early as possible with Messrs. Cooper, at No. 5, Victoria Street, Westminster.

Candle and Calorific Power at High Pressures.

A SERVICEABLE work has been done by Mr. E. W. Smith in the lecture he delivered last Saturday at the Manchester University; this being the first of the course arranged for the present winter session, by the University authorities in conjunction with the Manchester Gas Associations—senior and junior. The lectures proved very popular last session, and constituted a really valuable record; and the promise is that those for this session will be equally so. The first one gives a good lead. Much of the matter that Mr. Smith has incorporated in the lecture is already on scattered record. But it has required a vast amount of industry and talent to bring it together in the form in which we have it presented here. The salient features of the work of many years on such subjects as the effect of compression on gas in mains and the flow of gas in high-pressure systems, could only be extracted, handled, and commented upon by an industrious student of them. Taking the second subject first, because it may be dismissed in a few words. The lecturer is not yet in a position to add much to the published information on the question of the flow of gas under higher pressures than the normal; but we are hoping that before long there will be some useful results from the systematic tests that are going to be made on the Birmingham distribution system, and especially in relation to the effect of bends, tees, and so forth. In regard to the influences that these interruptions to direct flow have upon pressures, much of the work that has been done has been of an elementary experimental character, and under conditions that do not conform with those obtaining in our subterranean pipe systems, or under conditions that apply more to other countries than to our own. We shall, and the gas profession will, look with interest to the results of the investigation of such matters as these at Birmingham, where there are exceptional and abundant facilities for the work being performed, and, what is also of great importance, where there are men who have the capacity and inclination for such work.

Of greater immediate importance is the effect of compression on town gas in its distribution and transmission. Mr. Smith brings together the evidence of a long chain of investigation, which shows how well established are current views regarding the effect of compression upon gas; and in the tail of this section of the lecture, we are afraid the practical men of the gas industry, generally speaking, will take a greater interest than in all the well-compacted gleanings that form as it were the premisses to deduction and the fundamental support of current opinion. It is an excellent argument that we have here for the much-desired change in the parliamentary standard of quality for our gas supply; and the growing employment of high-pressure distribution furnishes an additional reason why this change should be brought about, and that early. We have heard gas engineering experts solemnly declare (and on one occasion not long since there was occasion to take one to task over the matter) that there was a fairly definite relation between illuminating power and calorific value. The information produced in the lecture was as available to that expert as to Mr. Smith. The percentage of the thermal value of a gas supplied by the illuminant constituents is small compared with that of the non-illuminant constituents; and as we proceed upwards in the scale of illuminating values, compression increases in larger proportion the depreciation of illuminating power than of calorific value. And, further, as compression increases, so the question of the condensation of the illuminants becomes a more and more serious matter, if a high illuminating standard has to be satisfied. These are of the considerations that, in the days when the bulk of gas is required for its calorific value, and when use is being made of the higher pressures in distribution for supplementing supply in distant areas (what happens to the illuminants of gas for high-pressure lighting and industrial supply does not matter much), assist determination as to the right policy to pursue in relation to the qualitative standard of town gas supply.

Gas of low illuminating quality does not suffer nearly so much from compression as gas of the higher qualities. Indeed, we have Mr. F. C. Willis, of South Shields, in the paper (supplementing one presented in May) that he read on Saturday at the meeting of the North of England Association telling us that, in careful tests that have been made at Tynemouth with 14·70-candle uncompressed gas ("Metropolitan" No. 2 burner), it has been found that, after compression and at 7½ miles from the works, the illuminating power only fell 2·6 per cent., while the gross calorific value (in calories) showed a diminution of 3·06 per cent. The percentages appear to be a little at variance with the results of all other investigation—theoretical and practical; but the interest of the matter for our present purpose lies in the slight effect that compression has upon this relatively low illuminating quality of gas in respect of both the illuminating and calorific values. Mr. Willis does not give the pressure figures at the works and at the place of experiment away from the works.

To return to Mr. Smith's lecture, there is one quotation to make in which there is concentrated a large amount of information. It is this: "An average coal gas compressed up "to 40 lbs. to the square inch will suffer very little loss in "candle power. The loss in B.Th.U. is still less. In other "cases, the temperature to which the gas is subsequently "cooled is a leading factor, controlling the amount of condensation. The composition of the illuminants also largely "controls their loss, and the effect of the loss on the candle "power." The area covered by the lecture is far too great for any general discussion, but, for the present, the question referred to here is of central importance. Mr. Smith will find something in Mr. Willis' supplementary paper that will interest him in connection with the subject of the effect of compression on gas and that of the flow of gas through high-pressure mains; and Mr. Willis will certainly find that Mr. Smith has given abundantly of the fruit of his researches into matters that have been and are now engaging attention at North Shields.

Views from a Long Experience.

IT is stimulating and pleasant to hear the observations on gas affairs of one with such long experience as Mr. Henry Tobey, of Malton, who, with a quarter of a century intervening, has twice filled the presidential chair of the North of England Gas Managers' Association. In the chatty address with which he on Saturday last opened his present year of office, Mr. Tobey, while tempted to indulge in reminiscence, declared that he would forbear. Yet, in a measure, he was reminiscent. The changes that have been effected in the gas industry in the past quarter of a century were too strong for him to resist; and in alluding to those changes, he leads us to ask, Who has helped most in effecting these changes on the consumers' side of the meter—the gas suppliers or makers of gas-lighting appliances, gas fires and stoves, and the hundred-and-one things that all demand gas for their serviceable application? Without hesitation, we assert that the manufacturers have been the larger contributors to the advantage of both gas consumer and supplier on the consumers' side of the meter than the gas suppliers themselves. The gas suppliers have devoted themselves to the improvement of their manufacturing returns, and to popularizing gas supply in the houses and premises of the consumers. But they have done, speaking generally, but a small part in developing the efficiency of the appliances that they handle, with the view of encouraging, cultivating, and maintaining business. We are glad to see the acknowledgment made by the President of the work of the manufacturers. They deserve it. But, of course, manufacturers will view with somewhat mingled feelings his remark "Gas "suppliers have not been slow to appreciate the efforts of "the manufacturers to produce efficient appliances such as "would take the taste of the public, and would be of advantage in obtaining new customers." What a text that would make for some ardent spirit speaking from the ranks of the manufacturers! Forsooth, there has confessedly been a touch of selfishness about the form of the appreciation. But we will refrain from commenting upon it.

Mr. Tobey has a friendly tilt at the "JOURNAL" in looking back at the early days of the Welsbach mantle. In 1886 (we will accept the statement without reference, as what he says quite accords with the views of the time), he says that it was stated in these columns that the Welsbach burner was apparently not destined to prove any stronger foe to

electric lighting than any other description of gas-burner. Those were the days of Welsbach's original mantle, which proved practically a dead-failure; and it was not until a few years later that the famous inventor discovered wherein his first formula was seriously defective. After that, what was in 1886 referred to in qualified terms altogether changed; and the irresistible headway of the incandescent mantle started. It has formed the means of progress upon progress, and has enabled the gas industry to keep well ahead—with all the forward movement of the competitor—in both economy and efficiency; and the mantle after it passed from its soulless condition has ever had a staunch advocate and friend in the "JOURNAL." However, we will not linger over what is common knowledge and history as to the progress of the industry, but may leave the matter with the remark that we are well content with the position of to-day.

Among the changes there have been those that have pressed hardly upon small gas undertakings in towns and districts that have reached a stage where further development appears to be a thing that cannot be hoped for. Those undertakings make, in most cases, though not in all, the best possible use of the advances that new appliances offer them and their customers. But there are promoters of electrical concerns who are fatuous enough to believe that an electricity supply undertaking can be established in such places that will evict gas and leave electricity a profitable future. But the result is, as a rule, just what might be expected. The new-comer merely cuts into the profits of the gas undertaking, reaches a point beyond which it cannot itself make progress, and then pursues a penurious career. Competition of this kind came to the Malton Gas Company; and not only did the Company suffer, but the district as well. This part of the address is worth special attention; for though the story is not new, there is a freshness about it as told by Mr. Tobey. To make up for their loss, the Gas Company had to press forward with the cultivation of the smaller class of business, which involved a larger expenditure on tenant's chattels. Under such circumstances, the Company sought a reduction of their assessment; but the Assessment Committee increased it, and forced an appeal to Quarter Sessions, with the result that the Company secured a larger reduction of their rating than was sought, and a serious amount of costs fell upon the Poor Law Union. The source of all this trouble was electrical competition in a small town; and from the financial and commercial point of view, there does not appear to have been any material gain for anyone. The President, while on this topic, avowed himself a deadly enemy of the hypothetical tenant, and again introduced argument in support of a revision of the acknowledged defective basis on which gas undertakings are now assessed.

But we are disinclined to accept the President's views as to the policy of small undertakings refraining from obtaining statutory powers. He does not regard the rights that they secure as being of any commensurate value with the restrictions that are imposed upon them, though he recognizes that an Act gives a company security of tenure. Against this he sets his opinion that a company who are acting fairly and squarely, and are not rapacious in their dealings, have little fear of being disturbed. We should be heart and soul with Mr. Tobey in this matter if things were to-day—and prospectively showed that they would so continue—as they were years ago. Change has not been limited to the circumstances of the gas industry. There are large opportunities for anyone who is brought into close touch with the proceedings in the Parliamentary Committee Rooms, and with municipal affairs outside those rooms, to arrive at the very decided opinion that change has been going on in the constitution and policy of such bodies that is not to the comfort of non-statutory concerns such as gas companies who are subject—and the fact appearances suggest will make things still less comfortable in the future—to their goodwill and sanction. Against this the protection of statutory rights and powers is necessary. Further, the small districts are now the fields for the exploitation of electricity supply, through the municipal body, power company, or private company. Such exploitation is carried on under the powers of a Provisional Order or a Special Act of Parliament; and it would be a sad state, under any one of those conditions, for a gas company to be in operation without any rights independent of the local authority, and with a concern in competition possessing statutory powers.

Just one more point. The President says that "gas companies want to be of native growth, and not to be exploited "by aliens to the district, whose only object is to draw as "much revenue as can be extracted from the community." With the first part of the statement we are in absolute accord—when it can be done. With the second part, we are not in harmony where the local growth is not possible. Many districts to-day would still have been destitute of a gas supply without external aid; and we know of many districts that are served cheaply and well by companies that have been financed largely—perhaps in cases entirely—from outside. The fact is that it all depends upon who are the "aliens." There are, of course, "alien" promoters whom it would be well not to have on any terms.

We have enjoyed Mr. Tobey's address. There is a freshness and independence of view about it, from one who has long held an honoured place in the ranks of the British gas profession.

Gas and Electric Oven Efficiency.

THERE is a point on which the gas-stove manufacturers are challenged by their electrical competitors; and the challenge takes the form of as vague—and may we not add impudent?—an assertion as any they have ever made concerning the relations of modern incandescent gas lighting and modern electric lighting. It is this that, though a unit of electricity is only capable of producing for the user rather more than 3400 B.Th.U. (which unit is offered for cooking at, say, 1d.), and though a pennyworth of gas (at 2s. 6d. per 1000 cubic feet) is capable of generating 16,000 B.Th.U. and upwards, according to the composition of the gas, the efficiency of the gas-cooker is so low and the efficiency of the electric-oven so high that the actual costs for the service rendered is just about equal. We saw some figures published recently that attributed only a 12 per cent. efficiency to the gas-oven, while the electric-oven was credited with an efficiency of 80 per cent., which really makes the gas-oven appear worse than the electric-oven in the matter of the amount of heat necessarily and usefully employed. There is gross exaggeration as to the lowness of the efficiency figure for the gas-oven; but the fact that the statement is being zealously circulated as to consequent corresponding cost (though to their credit, be it said, many electricians recognize the folly of accepting the statement as true) is a reason for the point being just as zealously and properly controverted as it is being made. The only direction in which there is loss of heat from the gas-oven that does not obtain to the same extent in the electric-oven is in the flue; and one gas experimenter has placed the loss at 15 per cent. But on the other hand, experience shows that for pastry baking with the electric-cooker, there must be ventilation if a crisp and not a doughy result is required.

We ask of those who circulate these fabrications as to the low efficiency of the gas-oven, for details of their tests if any have been made—the names and types of gas-ovens, the means taken to determine the flue and radiation losses, the loss due to the opening of the oven-door, and so forth. Upon the supply of this information, there will be the greatest pleasure in putting a similar oven to similar test, and publishing not only the results, but the details of the methods adopted in carrying out the tests, which shall not be of less scientific accuracy than those which may have been applied (the figures to which we refer make us doubt whether any scientific tests have been applied by those interested in the matter electrically) by the electricians who father the statement we refer to. Our gas-stove manufacturers have to bear in mind that this is all a question of oven efficiency; even the electricians are not disposed to dispute that beyond the B.Th.U. of a unit of electricity at a given price, in the amount of gas to be obtained at that price there is a margin of heating power that makes the actual heating power of the unit of electricity shrink into insignificance. This being so, if we were imbecile enough to accept the efficiency valuations of the electricians, they must see, as we have before pointed out, how narrow is the ground for improved efficiency for the electric-oven, and how extensive that of the gas-cooker.

There are many other matters—notably installation and maintenance costs, reliability, convenience, &c.—besides the available heat of the gas and electricity, which, in culinary operations, make the former the superior of the latter. But these are matters that have been dealt with somewhat frequently of late in articles in our columns; and on this occasion the general question of temperature efficiency in relation to cost is a sufficient topic. Those electricians who

claim equality of cost, through the loose imputation as to the low efficiency of the gas-oven and the alleged high efficiency of the electric-oven, are of the few; a larger number of electricians speak, with a little more hesitation and greater looseness, of the "higher efficiencies" of the electric-oven making it possible to "approach" the costs of cooking by gas; while there are others who—probably they are those with the greatest experience—ridicule the exaggerations of their more volatile and less experienced *confrères*. The last-named found their opinions on the present position. They know that gas-ovens are not all of equal rank in the matter of efficiency; they know that it is of no use comparing the best constructed electric-oven with the most inefficient (probably old-fashioned) gas-oven; they know, too, of the thermal and price reserves that the gas industry have in this matter that cannot be claimed by the electrical industry; and they realize that, if need be, the gas industry would take prompt measures to make use of one or both these reserves. They are wise in not talking at large, as certain electricians have done, of a walk-over for electric cooking, as soon as its "merits" become known. The more the demerits of electric cookers become known by those who have them installed tentatively (we have had examples brought to our own knowledge), the less they have been used, till ultimately they have been laid on one side totally disregarded.

In an article contributed to the "Electrical Review," on "The Application of Electricity to Cooking-Ovens," the writer shows himself to be one of those who claim that, in consequence of the "higher efficiencies" of the electric-oven (he does not say which), "it is possible for the cost of electric cooking to approach the cost of gas or coal." Again, he does not say the type of gas-ovens that he has in view. But the other parts of his article put the case as fairly as could be expected from one whose bias must naturally incline to electricity. He points out that the initial difficulty electricity has to face is the wide difference in heat values. With coal at 17s. per ton, gas at 2s. 6d. per 1000 cubic feet, and electricity at 1d. per unit, the B.Th.U. to be obtained from a pennyworth of coal, gas, and electricity are approximately 115,300, 18,300, and 3410. From these figures, it would appear that it costs 5⅛ times as much to get any given amount of heat from gas as from coal; 34 times as much to get the same amount of heat from electricity as from coal; and rather more than 5⅛ times as much to get the same amount of heat from electricity as from gas. The author of the article remarks that heat from coal is relatively so cheap that few precautions are taken to utilize the total available thermal units to the best advantage. Similar remarks, he admits, apply to gas; for "though various precautions are certainly taken in gas-ovens of repute to minimize waste of gas, the limit of efficiency is not yet reached." That is a point we have before suggested that our electrical friends should bear in mind; and it is this point that, in the present article, we have called a reserve, and a reserve the electricity oven does not possess. The writer further agrees that it will not be a difficult problem to improve the heat utilization of gas-ovens. Then we come to the declaration that, as things are at present, and owing to the higher efficiencies of the electric-oven, it is possible for the cost of electric cooking to approach the cost of cooking by gas or coal. Using an electric-cooker and the 3410 B.Th.U. of a unit of electricity in the same time as a pennyworth of gas and its 18,300 B.Th.U. are being used in a gas-oven, we should like the writer of the article to explain where the additional 15,000 units of the gas disappear to. His statement places the percentage heat efficiency of the gas-oven on a very low plane indeed.

When we come to consider the heat efficiency of the electric-oven, we find the causes of heat absorption and channels of loss much the same as in the gas-oven. We have not in the gas-oven to raise and maintain the temperature of any heating element as in the electric-oven. The day may come when this will be the mode of heating even in the gas-oven. Both forms of oven have to raise and maintain the temperature of the air inside. Both have to raise and maintain the temperature of the internal metal work of the oven. In both there is absorption of heat in cooking the food. Both have to make good the heat lost by radiation, by convection, by leakage, and by opening the oven-door for any purpose. Speaking of the electric-oven, the writer of the article states that "perhaps the usual ventilation and leaky joints will add considerably to the total loss." Really we cannot see on *à priori* considerations, and by appeal to common sense, why the present-day gas-oven, if properly constructed with packed sides, should be assigned so low a place in contrast with the electric-oven in the rank of heat efficiency. This is a point that has not been satisfactorily answered by our electrical friends. While they are considering the reply to it, the gas industry may contemplate the general position with the utmost equanimity. For apart from the thermal and price reserves in hand, the unsolved problems surrounding the commercial electric-oven of all sizes, and for duty under ordinary (not electrical expert) conditions, appear to be many, and not only many but unsubmissive to the mental exertion that has been brought to bear upon them. Let it be borne in mind, too, that mere test results with electric-ovens do not necessarily resemble the results to be obtained in the dwelling-house; nor do the results of demonstration necessarily represent the products with the same appliance after a period's use. In the gas-oven there is nothing that is liable to change. What can be done one day can be done far into the future, without any change or repair, or the exercise of any particular skill.

The Publicity Conference on Thursday.

We again remind readers of the conference to be held on Thursday this week, at 3 o'clock, at the Institution of Mechanical Engineers, in connection with the Gas Publicity and Special Purposes Fund. The scheme for the British Commercial Gas Association has, we believe, aroused a considerable amount of attention; and the conference is likely to be of more than ordinary interest, in view of the feeling that the project bids fair to play an important part in the future work of the industry. The well-intentioned assistance to the movement that we rendered last week by giving, though the information was unavoidably only available towards the close of the work for our week's issue, the earliest possible publication to it, we are pleased to hear, from the President of the Institution (Mr. R. G. Shadbolt) and from several others associated with the scheme, is much appreciated; and we hope that it will have had some effect in contributing to a good attendance at the conference on Thursday. If evidence further than has already been published is wanted to convince of the need of an educational and defensive organization in the gas industry, we may refer readers to the article in another column on "The Daily Press and Rival Industries."

Defence against Strikes.

The necessity for organization among employers of labour to combat the ever-present tendency on the part of the workers to dislocate the trade of the country by striking to enforce either just or unjust demands, is becoming more and more widely recognized. It is not very long since a suggestion of this kind was made among the South Wales coalowners; and now another definite proposal comes from the London area. When, as we have recently seen, an employer is really bound to handle anything that is sent to him, and his employees claim the right (and try to bring the business of a country to a standstill to enforce it) to handle what they choose and leave the rest, it is high time that a determined stand was made. It may be argued that, in view of the disastrous results of their recent action in this particular matter, such a tactical blunder as that referred to here is not likely to be soon repeated. But there is no assurance that it will not be; and, even if there were, it would not be sufficient. Employers cannot afford to leave their businesses at the mercy of the Trade Unions, who have lately had things far too much their own way—that is, until the advent of the Irish railway strike.

Proposed Federation of London Manufacturers.

To come to the London proposal, a circular has been issued by the London Waterside Manufacturers' Association stating that, at a largely attended and representative meeting of London manufacturers held on Aug. 16 last, when the position arising from the London dock strike was considered, the following resolution was unanimously adopted: "That the London Waterside Manufacturers' Association are requested to promulgate a scheme whereby all manufacturers in London and district should be associated for the discussion of matters of mutual interest or co-operation for mutual defence." Communications have, it is stated, since been received which clearly show that there is a strong opinion among manufacturers that such a combination is desired; and at a meeting of the Council of the London Water-

side Manufacturers' Association held recently, it was considered that the objects of such a combination should especially be directed to defensive action in instances of strike troubles, &c.; and also to take such action as may be necessary for the protection of free labour, and to prevent unfair picketing. It is further suggested that the manufacturers should organize a Parliamentary Committee, who would be able to represent their views in the House of Commons. Accordingly, the Council of the Association announce that they are prepared to promote a Federation of Manufacturers for London and district, if they are satisfied that the majority of manufacturers desire such an organization. It is proposed that the scope of the Federation should be for London manufacturers in the police area (about 13 miles radius from Charing Cross), and for waterside manufacturers the present limits from Teddington to Maidstone and tributary waterways within the port. The idea is that there should be a limitation of members' liability based on the wages bill, and that a central council should be appointed, with a general committee and sectional committees for various trades. The London Waterside Manufacturers' Association desire to find out whether the formation of such a body would be approved of; and the circular in which this question is asked is influentially signed—among others by the Associated Portland Cement Manufacturers (1900), the South Metropolitan Gas Company, and the Thames Iron-Works, Shipbuilding, and Engineering Company.

Company Law

Dealing, in the "Twentieth General Annual Report on Companies" by the Board of Trade, with the question of uniformity of company laws throughout the Empire, Mr. H. Llewellyn Smith says it is clear that some progress in the direction of simplicity and uniformity has been made in the past four years; and that, as the importance of the subject is realized on every hand, there is good reason to hope that progress will be more rapid in the near future. It seems that at one of the meetings of the Imperial Conference held during the past summer, resolutions were proposed, both on behalf of Australia and New Zealand, in favour of such uniformity; and that a memorandum had been previously prepared by the Board of Trade and laid before the Conference showing the progress which had been made towards this goal since the previous meeting of the Imperial Conference in 1907. In that year, the number of Statutes in the United Kingdom, in India, and in the self-governing Dominions relating to the law of companies was 166; and in the present year, this total has been reduced to 132. In the Transvaal, Victoria, and British Columbia, Statutes have been passed following practically verbatim the British Consolidation Act of 1908. The adoption of the actual wording throughout of the British Statute, and the avoiding of anything in the nature of trifling deviations, appears to the Board of Trade to be a matter of considerable importance, inasmuch as the decisions of the Courts of this country interpreting the exact meaning of the words, and the various text-books which have been written on the subject, are thereby made available.

And Joint-Stock Business.

Turning to the record of matters within the Companies (Consolidation) Act of 1908 for the past year, it is found that the number of new companies registered in England and Wales in 1910 was 6707. Deducting from these 1958 companies which went into liquidation (excluding two cases in which winding-up proceedings were stayed) and 1868 companies which were removed from the register on the ground that they were no longer carrying on business, the net increase of the twelve months was 2881. The number of companies on the register in England and Wales on Dec. 31, 1910, excluding those which were in course of liquidation or removal from the register, was about 47,000. The power vested in the Board of Trade to appoint an auditor, if the appointment of auditors was not made at the annual general meeting of a company, was exercised in fourteen cases. Proceedings to enforce returns to the Registrar of Joint-Stock Companies, and to secure the filing of documents required by Statute to be filed for public information, were taken in 29 cases; fines being imposed in every instance. The total nominal capital of the companies registered in England and Wales last year was £205,146,594, which is an increase of about £60,000,000 over the highest figure of the preceding nine years. The activities of promoters in the directions of "rubber" and "oil" were, of course, largely responsible for last year's heavy total. The average amount of the nominal capital of each company registered also shows a large increase, from £22,654 in 1909 to £30,586 in 1910—this latter figure being the highest since the year 1903. The percentage of companies which do not issue a prospectus has not materially changed during the last three years; and the fact that there has been no increase is thought to be probably due to the influence of the section of the 1908 Act which requires companies other than private companies to file a statement giving practically the same information as that necessary in a prospectus.

RETIREMENT OF MR. JOSEPH MORRIS, OF JERSEY.

We learn that, after a period of nearly fifty years' active service, Mr. Joseph Morris has resigned the position of Engineer and Manager of the Jersey Gas Company. He does not, however, sever his connection with the undertaking, as he retains his office as Director. He is succeeded by his son, Mr. Harry Morris, who has for some years been associated with him in the management of the Company.

Mr. Morris was born at Coventry on July 29, 1830; and he entered the gas-works in that city in 1846 as a pupil of Mr. Alexander Angus Croll. While there he worked under Mr. Davis Methven, on whose removal to London, to join the Imperial Gas Company, the management of the Coventry works was entrusted to Mr. Morris. It was while he was acting in this capacity that the lease of the works was bought by Messrs. Robinson Bros., who then owned the undertakings at Leicester, Leamington, and Belfast. Shortly afterwards, Mr. Croll offered Mr. Morris the management of the Guernsey Gas-Works, which he accepted; and he left Coventry in July, 1851. Before taking up his duties in Guernsey, he went for a short time to the Bow Common Gas-Works, in order to gain additional experience, and was there associated with Mr. George Anderson. He assumed the management of the Guernsey works in September, 1851, and held it until 1863. During this period he designed and built the works of the Alderney Gas Company.

In January, 1863, Mr. Morris was appointed Engineer and Manager of the Jersey Gas-Works, which post he had been specially invited by the Directors of the Company to accept; and the duties connected with the position he continued to discharge up to his retirement, which took place on the 30th ult. In June, 1875, he was elected a Director of the Company; and from that date, he has always retained a seat on the Board. During his management, the Company made considerable strides; the make of gas in 1863 being 36 millions, whereas it has now risen to 200 millions, in spite of the population having decreased during this period. The price of gas, which in 1863 was 6s. 8d. per 1000 cubic feet, is now 3s. 4d.; and from 1894 to 1899 it was as low as 3s.

In 1894, Mr. Morris undertook the design and erection of complete new works on a site bordering the original property of the Company. This work he carried out almost entirely with men under his direct supervision, and practically without assistance by contractors. The works were brought into operation in 1899, and have since been giving the most satisfactory results. It was a source of great gratification when Messrs. Corbet Woodall and Son reported, in May, 1910, that the works would bear most favourable comparison with the most modern works in Great Britain or elsewhere, and in respect of results were equal to anything within their experience.

We cordially wish Mr. Morris good health to enjoy the leisure which his retirement from active work will give him.

Personal.

At a meeting of the Directors of the Radcliffe and Pilkington Gas Company last Wednesday, Mr. James Braddock, the Manager and Secretary, was presented by the Board with a handsome silver tea and coffee service, in recognition of his thirty years' connection with the Company. The presentation was made by Alderman J. K. Butcher (the Chairman), who expressed appreciation of the services Mr. Braddock had rendered, and the best wishes for his future. His complimentary references were endorsed by his colleagues. Mr. Braddock appropriately acknowledged the gift and the sentiments that had been expressed. The tray bore the following inscription: "Presented to Mr. James Braddock by the Radcliffe and Pilkington Gas Company, as a token of esteem, and in recognition of faithful services to the Company as Manager and Secretary during the past thirty years. —Gas-Works, Radcliffe, Oct. 4, 1911."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 134.)

THE Stock Exchange has had an interesting and instructive week. War has been raging—delicately—in Europe all this time; but Capel Court has kept its head. In this mood it was strongly aided and abetted by its sister institutions on the Continent; and it is remarkable that there "Turks" have been the firmest line in the market. So that the week has proceeded and has closed without any terrors. The opening day was inactive (it being one of the most solemn fasts in the Jewish Calendar), but was quite cheerful, as if determined to make the best of everything. Consols were shy at first; but they plucked up, and closed ⅛ higher. Rails and Americans were good all through, and Foreign were firm and confident. This bright tone was well maintained on Tuesday. Consols were a little higher, and Rails continued to pursue their upward course; while the rest were firm. Wednesday was less enthusiastic, and business was quiet and variable. Consols stood firm; but Rails fell back somewhat, and Americans were irregular. Thursday was a quiet day. Markets became lethargic, demanding something more eventful in the way of war news. But the gilt-edged division was firm, and Consols rose higher. Business was not more active on Friday; but the tendency was favourable. Government issues, headed by Consols, were strong. Americans were higher, and the Foreign Market was firm. The tone generally was not so good on Saturday; the position of foreign affairs and our home labour unrest being regarded as less satisfactory. Movements were not, however, of considerable magnitude. Consols closed at 77⅜ to 77⅝—a rise of ⅜ in the week. In the Money Market, the supply was superabundant at easy rates, and discount terms relaxed. Business in the Gas Market was much more active, coming back to its proper level after the close of the holiday season. A good many issues advanced in quotation; but one or two went the other way. In Gaslight and Coke, the ordinary was active. The opening price was 106½, which was not afterwards exceeded, and at the close touched 104¾—a fall of 1. In the secured issues, the maximum and the preference rose 1 each. The preference realized 101½ special and 103, and the debenture 81½. South Metropolitan was unchanged at from 116¼ to 117½; and the debenture made from 80 to 81. In Commercials, the 4 per cent. changed hands at from 111¼ to 112¼, and the 3½ per cent. at 106½. Among the Suburban and Provincial group, Alliance and Dublin showed transactions at 83½, Brighton ordinary at 157½ and 158, British at from 45 to 45½, ditto debenture at 95, Bromley "B" at 89½ and 90 (a rise of 2½), Ilford "A" at 152 and 152½, Lea Bridge at 119½, Portsea "C" at 121 (a rise of 3½), South Suburban at 120 (a rise of ½), Southampton at 108¾, and, on the local Exchange, Liverpool "B" at 165. In the Continental companies, Imperial was marked at from 181½ to 183, and European at from 18⅜ to 19¼. Among the undertakings of the remoter world, Bombay realized 6 3/16, Buenos Ayres debenture 95½ and 96⅞, Cape Town preference 4, Melbourne 4½ per cent. 100½, Monte Video 12½ (a fall of ½), and Oriental 138½ and 139. Primitiva was very active, the ordinary at from 7⅜ to 7⅞, and the preference at from 5¼ to 5⅜.

ELECTRICITY SUPPLY MEMORANDA.

Compassion of the Daily Press—Heating by Electricity—More Public Interest Wanted—Eccen-Tricities—Gathered by the Way—Street Lighting Again.

SEVERAL of the daily newspapers have taken compassion on the Electrical Exhibition at Olympia, and have listened to the cry for assistance to arouse public interest in it. But public interest wants strong inducements; without, it is a heavy specimen of immobility. The form of assistance rendered by the Daily Press has been to take one or more features of the exhibition, and to write lightly and blithely about it or them. The Engineering Correspondent of the "Daily Telegraph" has adopted this method; and his generous nature, in his desire to help those who failed to help themselves in a proper manner at the proper time, has led him into a few extravagances, which will no doubt be recognized even by the public for whom he writes. One of his articles is headed "The Electrical Era: Popular Method of Heating." An already "popular" method of heating does not require such support as is extended to it in what follows. "The large lamps of the electric radiator emit heat rays which warm everyone and everything *near enough* to be affected by them." Near enough! Well put. "The temperature of the air is raised, but none of the air is consumed, nor is it vitiated." There is another sanitary system of heating that heats the room by radiation, assists in keeping the air of the room fresh, and does not vitiate the atmosphere. "Generosity" omits to mention this system, which, moreover, is cheaper than the electric radiator. By it, too, "we can regulate the temperature of a room as easily as we can regulate the amount of light." All that can be said in favour of the electric radiator can be said about the gas-fire—and more. But our popular educator regards the gas-fire as only a "stage" in the inevitable evolution of the household. It is growing to be a particularly large and permanent stage. Our gas-fire makers have had to take special steps to supply requirements; and some of our gas undertakings find it difficult to obtain sufficient fully qualified gas-fitters for the rush of work. Our popular educator kindly assigns the heat of gas to the gas-engine as its proper place, for driving a dynamo to generate electricity. Then he tells us that, *when* coal has been changed into electricity, we may be sure that nothing is wasted. That depends on the relation of the place of generation and the place of use; and what of the waste between the stages of coal and the actual production of the electricity? Again, "with an electric fire nothing is wasted. . . . We are as comfortable in this country during winter, with the electric radiator in the room, as we should be if our home was situated in a more temperate climate." The "Engineering Correspondent" can surely not have tried the effect of an electric radiator in an ordinary room on an icy cold day.

But the main purpose of the article was to induce people to visit Olympia. If what we have seen on our occasional visits to the show may be taken to be fairly representative conditions, the public have not been induced to visit it in any great numbers. There was a little more animation last week during the evenings; but most of those who were there appeared to know all about it. Little knots of people stood round about stands where there was something in motion—such as a cook or a demonstrator dilating on the merits of electric cooking; but elsewhere the gangways were sparsely occupied. Perhaps our visits were on bad nights; but inquiries at certain stands elicited the information that, on the whole, the exhibitors were not highly elated over the response of the public. We have wandered through the space occupied by the Electricity Publicity Committee without once being accosted. On the last occasion of our visit, there was no one there, save a commissionaire; and he did not vouchsafe any information concerning the merits or otherwise of electric lighting, heating, cooking, or power. What opportunities wasted for trying to effect our conversion! And this neglect of members of the public inside, while the Press outside have been hammering away, more or less honestly, in the endeavour to arouse the interest of the public to get them to Olympia!

We were of the small audience gathered round the "Tricity" appliances demonstration stand one evening last week. The front chairs were early occupied by ladies fair. They lingered after the lecture, and seemed on intimate terms with the sprightly-tongued gentleman who lectured. Some of the ladies were seen occupying practically the same places at subsequent lectures. Were they there filling the double *rôle* of decoys (we ask for pardon ladies), and judges of the products? We only ask the question for personal interest. However, their presence before the lecture tempted wayfarers to assist in supplementing the small audience; and they were useful during the lecture in bearing witness to the lecturer's assertions that the food was well and truly cooked. It was really a delightful half hour. One had to take much of what the sprightly tongued gentleman said either for granted or with a grain of salt. There were no meters there or thermometers to test the truth of his assertions. He had some puff-pastry prepared on which it seemed (from the point of observation) had a good sized blue-bottle perched, he (the blue-bottle) might have endangered his life, owing to the thinness and lightness of the pastry. A duplex oven had already evidently been undergoing heating for some time before. Our demonstrator said that the pastry would be well done in ten minutes. He asserted later that nine-and-a-half minutes had sufficed. Our watches did not agree. The demonstration consisted entirely of the infinitesimal. A slice of bacon was grilled, cut thin—the thickness being, according to our masculine judgment, just about sufficient to allow it to hang together without parting into shreds. A thin piece of bread was also toasted; and this the ladies fair on the front seats pronounced, as with one voice, to be good. The pastry by the way, it was understood, had had a little brown sugar placed on the top to give it a glazed surface, as well as to heighten the colour. Judging from the awfully anæmic look of the pastry, cakes, cutlets, fowls, and so on in the exhibition, illustrating the products of various electric-ovens, a little colouring matter would be extremely useful to change their complexion. We also had a demonstration with a kettle containing a little water. This kettle had been standing on the top of the heated oven, and so the water had already reached probably near boiling-point. It was removed to a separate heater; the switch turned on; and "Sukey" started almost at once belching off steam. Wonderful! The audience smiled, including the ladies in the front row.

We were also told about the marvellous performances of the electric-oven. There is no escape of heat from this thin-cased oven. That is the statement. Providence seems, in its dispensation of gifts, to have been more liberal to electricity than to any other heating agent, and in some mysterious kind of way. B.Th.U.'s do not count. The cost comes out cheaper than coal, and is not dearer than gas—that is the "Tricity" statement. Moreover, pounds in hard cash are retained in the householder's pockets by using electricity and not gas through the saving in the waste of meat—that, too, is a "Tricity" statement that has been adopted, with variations, by the representatives of the makers of other electric cookers. Gas! It is impossible with it to regulate the heat in the oven as with electricity—that is a still further "Tricity" statement. And why? Because the pressure of gas jumps up and down—apparently like a Jack-in-the-Box—from anything between ½ inch and 3 inches. This was understood to be the contention and the belief. We hear quite a lot about ourselves when we leave practical daily experience, and get among electrical showmen who have not the daily experience. But there is another important thing. Some gas-stoves have a nice white enamelled interior. A shiny interior is the proper thing for an oven, according to the "Tricity" theory,

because heat can be reflected just the same as light. All the other electric-ovens in the exhibition have dark—some densely black—interiors; so that their makers are not smitten with the "Tricity" theory. The "Tricity" oven is a thin metal casing, so light that the cook can lift it off its heater with the greatest ease. When new it has a highly polished surface both inside and outside. "No heat can escape from this oven," says our lecturer who so well knows his story. But he takes good care to use a duster before lifting the oven off the heater by means of the side handles, which handles are not inside the oven. Why cannot heat escape? Because of the inside highly polished surface which reflects back the heat. That is what we are told. From a convenient place, we peeped inside the oven, and found the bright surface had become somewhat faded, particularly on the interior of the door. But the heat, according to the theory, is kept back by a highly polished surface. But the theory appears to be controverted by certain of the acts of the "Tricity" people themselves. Some of the cooking utensils (those without copper bottoms) are highly polished externally. Therefore it should follow that, when these are placed on a heater, they should repel the heat. We were also told that that celebrated authority on electricity, Professor Fleming, had stated, in his Cantor lectures, that cooking by electricity at 1d. per unit was as cheap as by gas at 2s. 6d. We do not remember Professor Fleming (whose lecture was published and commented upon a fortnight since in the "JOURNAL") positively saying anything of the kind. But we do remember he said much else about electric cooking that was not trotted out at the "Tricity" stand. And the price of this outfit, said our friend, is (exclusive of fitting up)—let's see, was it nine or ten guineas?

We went elsewhere and saw and heard things very similar to what had been gathered at the demonstration referred to. Anæmic looking cakes and tarts, fish cakes, and so forth were on view; but nowhere could any test be made of consumptions or heats. Most vague assertions were, however, freely scattered on both heads, as well as regarding costs. The only definite figures as to costs were the prices of the ovens and other culinary accessories, which made the ordinary man shudder. At one place there was a chef toasting bread. On a stand at his side was a tiny saucepan containing a small quantity of stew. How long has the saucepan been on, inquired a gas-engineering friend. "Two hours" was Alphonso's reply. "And not boiling yet?" "Pouf! I put in this plug, and see." We then saw steam. "What are you doing there—toasting?" "Yes. You cannot do this with gas. You toast with gas, you get the blue flame on your bread, and the bread tastes. Bah!" So we went on from stand to stand, ever learning more and more of ourselves from electrical sources, and confirming more and more the knowledge already possessed on the subject of electric cooking and heating. There is one thing pretty evident, that the electric cooker and heater manufacturers do not view each other's wares with any particular friendliness, judging from the different tales about competitors' goods gathered by the way. However, the things heard of gas—of its vileness and its costliness, and so forth, after a quarter of a century's use for cooking and heating, and with experience in millions of homes to-day, seemed petty, were certainly truthless. We passed on homeward way meditating on the large part that fiction and falsehood play in some directions in the commercial life.

The innocence of the "Electrical Review," and its ignorance of any advance on the part of gas-lighting, are as amusing as the occasional grandiloquent style into which it drops. It has again turned its thoughts in the direction of street lighting; and it again, with grandfatherly persistence, tells the old Sheerness story that it trots out whenever occasion offers, as though the sum and substance of street-lighting experience was confined to Sheerness, and there was no Westminster or other borough in the Metropolis, or other town in the Provinces where there is a large and growing experience of modern gas lighting. We would that our friends of the "Review" would leave their weather-beaten outlook, and come down to the plains and see things as they are to-day, when dealing with gas affairs. In the article before us, of course the electric light is the superior in illumination and economy of anything gas can do. Gas has now to rely for the maintenance of its long-continued monopoly upon exceptional circumstances rather than sound commercial principles; and it is interesting to note the struggles of the gas interests to hold their own in the competition. So we read. Among other matters, we learn something new about the Holborn joint contract under which the streets are to be lighted partly by gas and the remainder by electricity—an arrangement [this is the new point] "which indicates a policy of lighting by electricity where the Company's cables are laid, and by gas where there are only gas-mains." The statement is absurd. Of course, it is also "well known," to our contemporary, "that the gas mantle deteriorates so rapidly that after a few weeks the illumination is considerably reduced." It is a pity that our contemporary cannot find something fresh to say about the mantle, instead of clinging to these old musty skeletons of the electrical imagination. We ask our contemporary to quote these calculations as to the lighting of Westminster:

	Cost per Mile per Annum.	Cost per Candle Power per Annum.	Candle Power per Mile.
Electric lighting	£555 ..	11·38d. ..	11,911
Gas, high and low pressure (combined)	255 ..	3·80d. ..	15,938
High pressure . . .	825 ..	1·84d. ..	96,891
Low pressure . . .	210 ..	5·12d. ..	9,589

There are only 4 miles lighted by high-pressure gas, but 51 miles by low-pressure gas-lamps, and 44 miles by electric lamps. The figures are worth very careful study by our contemporary, as well as by others who are considering the question of street lighting. They have a greater eloquence about them than such small and antiquated talk as that to which our contemporary has treated its readers in its article on "Competition for Street Lighting."

With due humiliation, tempered by a certain feeling of gratification, we read what Mr. H. E. Goody (writing in the "Electrical Engineer") thinks about the gas industry, and its commodity:

> We have a good thing, and we don't sell it nearly as well as we should do. The gas companies have an immensely inferior commodity to dispose of; and they dispose of it to an extent which can only be explained by their indefatigable advertising. As an illuminant, electricity, properly advertised, might have completely ousted gas from the Englishman's domestic interior ten years ago. The gas companies spend freely in telling fairy tales about the thing they have to sell; and if the electrical interests would only disburse a quarter as much in propagating the truth about electricity, they would sweep the board. The contrast between gas and electrical publicity methods is so extremely obvious that no one can possibly overlook it.

Now we know what a little stands between the gas industry and absolute ruin.

THE DAILY PRESS AND RIVAL INDUSTRIES.

Views of the "Engineering Correspondent" of the "Daily Telegraph."

AN article that appeared in the "Daily Telegraph" last Saturday leads us to ask: Is there only one "Engineering Correspondent" of that paper? If there is only one, he has departed from his old neutral ground in dealing with matters affecting the gas and electrical industries, and his attitude has entirely changed. Only on June 26 last, there was an article, under the heading of "Engineering Notes" in that paper, in which it was said: "We have stated before that we hold no especial brief for gas or electricity; and there is little need to emphasize the fact that we hope to see both of these branches of engineering work develop. There is room for both." That is a very proper attitude for any daily paper to take up. But what is the character of the article of "Our Engineering Correspondent" now before us? It has obviously been indited with the spirit of prejudice against gas running through it, and a deliberate advocacy of all things electrical connected with illumination. In fact, a canvasser for an electricity supply undertaking could not have postulated more than is done, or said more that is unfair to gas lighting than is said, in this article. The neutral attitude has altogether disappeared. We regret to have to say that the article shows either deplorable ignorance of the advances, and of certain scientific aspects, of gas lighting, or, if there is not ignorance, then a peculiar unjustness towards gas lighting. It is for the writer of the article to choose, and to say which of the alternatives is the proper reason for the spirit found throughout the whole article. If there is ignorance, then we are not a little surprised that, before adopting a dogmatic line in a paper of the standing of the "Daily Telegraph," there was not deeper investigation into the actual position of gas lighting, in order that a judicial course might have been taken, and fair play given. The article is really inexplicable, attributing as it does the authorship to "Our Engineering Correspondent;" and we cannot find any reason whatever to account (unless there is more than one "Engineering Correspondent" contributing to the "Daily Telegraph") for his rapid change of front.

The article occupies practically a column of our morning contemporary, so that we will content ourselves with treating of the more prominent parts in which gas lighting is attacked directly or otherwise, and leave the other matter (from our point of view), fulsomely laudatory of the merits of electricity, to go for what it is worth. The first points to which exception is taken are in these quotations: "For outdoor illumination, such as shops, streets, and workshops, the arc lamp has firmly established its superiority." "The golden light from these lamps . . . is unequalled for lighting shop exteriors." "They are superior to incandescent gas in all respects. Recent tests of gas for street lighting showed that burners rated at 80-candle power would never give more than 40-candle power; 50-candle power electric lamps gave as much as 53, and never less than 50 candle power." We should like to ask the "Engineering Correspondent" whether he has seen the high-pressure lighting with inverted gas-lamps in Whitehall and other parts of Westminster, and the low-pressure inverted gas-lamps there and elsewhere; whether he ever saw a more equally diffused, brilliant, and steadier illumination by means of flame arc lamps of like candle power; and whether he has studied the costs of these lamps in comparison with electricity. It can hardly be believed that he has not seen the lights; and as to the costs, we recommend him to look into the figures given in our "Electricity Supply Memoranda" this week, which will supply him with costs worked out from the official tests of the City authority. We cannot for the life of us imagine, with such testimony so near at hand, how the extravagant assertions came to be made in the columns of our daily contemporary. There is another matter upon which there is an apparent want of knowledge, and that is with regard to the "golden light" of the flame-arc lamp being unequalled for shop lighting. The "golden light" has been evicted by numerous shopkeepers who have had enough of the jumpy, expensive (all costs counted) arc lights in favour of the high-pressure gas-lamp, in stretches of streets in London and the suburbs, under what is known as the

parade system of shop lighting. This was, of course, unknown to the "Engineering Correspondent," who was consequently ill-informed. The fact has such a large existence that there can be no denial. Let him go to Streatham, Lewisham, Shepherd's Bush, and other shopping centres of London and farther afield; and he will see for himself. The gas companies will be pleased to furnish him with all directions for making investigation. In two roads (Askew and Uxbridge Roads) of Shepherd's Bush alone—in the Hammersmith Borough Council electricity supply area—111 electric arc lamps have recently been displaced by high-pressure gas-lamps from shop fronts. We ask the "Engineering Correspondent" to tell us why these things are if the flame arc lamp has established such an enviable position as he alleges. What we are saying is capable of very easy proof by our friend; and we ask him to do the gas industry the justice of acknowledging it with the same prominence as the present article has received. As to the tests of the incandescent mantles to which he alludes, will he tell us who made them, where they were made, whether the mantles were of the inverted or upright types, and the make of burner on which the mantles were used? We can, in return, supply him with tests not made electrically, but independent official tests. As to the point regarding the reduction of gas mantles to ruins, probably "Our Engineering Correspondent" never heard of wind-proof gas-lanterns, and of the longevity—in practice, not in imagination—of the inverted gas mantle on its rigid support.

On the point of costs, the writer of the article says that if four flame arc lamps are run in series for four shopkeepers, they will cost, with carbons, 6¼d. per hour; and each consumer will get his light for 1⅝d. per hour. "This economy," he adds, "by combined working is, *of course, impossible with any other illuminant than electricity*." Why "of course" and why "impossible"? We would point out to our friend that he does not say what is the reputed candle power of these lamps, nor the price of the current, nor whether the price includes capital expenditure, attendance, cleaning, and repair. His statement is vague. Only a week ago, we published a paper by Mr. W. B. Farquhar, Gas Engineer to the Ilford Gas Company, in which he described the scheme for the supply, at an inclusive cost, of high-power gas-lamps to shopkeepers in his district, and for such a district he has a large installation under the parade lighting system. He supplies high-pressure inverted gas-lamps of 1000-candle power—gas, mantles, attendance, lighting and extinguishing, and repair—and the total cost to each shopkeeper (without reference to his neighbour), for 800 hours' lighting, works out to 1·2d. per hour. And not another single penny piece is demanded of the shopkeeper from first to last. Does "Our Engineering Correspondent's" figure of 1⅝d. include all this? Proceeding, our friend says: "An important point for shops is that there are no products of combustion from the electric lamp." Dr. E. W. Marchant, Professor of Electrical Engineering at the Liverpool University, was saying, in a paper read before the Illuminating Engineering Society last December: "With one exception, these lamps all give off a good deal of fume and vapour, which make them unsuitable for indoor lighting." There are several other expert authorities on this point; and the matter is also capable of proof. Will the "Engineering Correspondent" deny the truth of the assertion of these experts by adhering to his statement? We think not.

A section of the article deals with household lighting; and we will discuss with our friend some of the points he makes if he will produce the authority for his statements, and say categorically what he means by them. The first is: "That every house should be lighted electrically for the good health of the occupiers is the *unanimous* opinion of doctors and scientists." The second is: "The pernicious effects of sulphur compounds on paint, leather bindings of books, &c., are too well known to need emphasizing." The third point is: "The flame of an oil-lamp or gas-burner pours out as much carbonic acid into the air as do two adult persons." We will leave the oil-lamp out of the question, and confine ourselves to a gas-burner of specific consumption—say, a 50-candle power inverted burner, consuming 2½ cubic feet of gas an hour. While our friend is dealing with this point, and telling us of the amount of carbonic acid gas in 10,000 parts of air found in a room lighted by such a lamp, perhaps he will also inform us what is the noxious difference between the carbonic acid from such a burner and that given off by human respiration. The fourth point is as to the absence of danger from fire with electricity. Will he supply us with a list of fires that have occurred through electric light installations (say) during the past two years? And will he further inform us how much loss in certain cases the fire insurance companies have suffered by fires that have been produced through electrical causes.

We think "Our Engineering Correspondent" will not refuse to discuss the points raised in this article if he is the writer of the words that appeared on June 26 last in the "Daily Telegraph." Let us once more quote them:

> We have stated before, that we hold no especial brief for gas or electricity; and there is little need to emphasize the fact that we hope to see both of these branches of engineering work develop. There is room for both.

From these words, there is such a wide departure in the article we have criticized that the gas industry has a perfect right to an explanation, and to a substantiation or correction, in the columns of our morning contemporary, of the statements that are now published.

A GAS-ENGINE HANDBOOK.*

This practical treatise on the internal combustion engine is intended by the author for the use of "engine builders, engineers, mechanical draughtsmen, engineering students, users of internal combustion engines, and others."

The book is, of its kind, excellent; but there is no gainsaying the fact that it is more suited to the use of the gas-engine designer and builder, engineers engaged in the repair work of gas-engines, and students, than for users and those engaged in the manufacture and supply of gas.

The work is of considerable dimensions, and is divided into seven chapters, in which are contained 222 pages. The author early decides there must be no ambiguity on the size of the gas-engine required for any given power. He deals with this matter in the preface to the first edition, and gives rules by which the size may be calculated. In this connection, comparison is made with steam-engines.

Chapter I. treats of the "Methods of Working" of the various types of engines, followed by the "Output of the Engine" in Chapter II. In the remaining chapters, a mass of information is given under the headings of "Main Dimensions of the Engine," "Effect of Inertia of Reciprocating Parts," and the "Forces Acting on the Crosshead, Piston, Connecting-Rod, and the Main Bearings." The various strains and stresses exerted upon component parts of the gas-engine are carefully explained in full detail; the most complete rules and formulæ are given for the calculation of the construction of every part of an engine; no detail being too small or unimportant to receive attention. The book, it is easy to conceive, will be welcomed with open arms by those engaged in the technical details of the building, testing, and adjustment of gas-engines.

The last section of Chapter VII. deals in an interesting manner with the comparative cost of gas and steam engines. This question is discussed in all its bearings as regards cost of installation, depreciation, working expenses, and the consumption and price of fuel; all figures being calculated to "per H.P. hour."

In Appendix 1, the principle and working of the Humphrey pump is explained at considerable length; and a thorough grasp of the method of working is rendered easy by the use of a large number of comprehensive illustrations and diagrams. The whole description of this ingenious pump is excellent, and is quite the best the reviewer has seen. Appendix 2 contains some forty tables for the use of the reader.

The work is in every respect of a very high standard, and may be strongly recommended to those who wish to make a study of the technical details of the internal combustion engine.

* "A Handbook on the Gas-Engine." By Herman Haeder; translated from the German and edited by W. M. Huskisson, A.M.I.E.E. London: Crosby Lockwood and Son; 1911. [18s. net.]

COAL BYE-PRODUCTS IN AUSTRALIA.

In the last number of the "Journal," it was mentioned that a Company had been formed to carry on the business of manufacturers of, and dealers in, coke, coal tar, pitch, and other bye-products of coal; and that it is proposed to erect modern coking and bye-product plant in the neighbourhood of Newcastle, in the northern colliery district of New South Wales—the most important coalfield in Australia. It appears, from the prospectus of the Company as recently issued, that the demand for coke in Australia is steadily increasing.

The Company's Consulting Engineer is Professor W. Galloway, F.G.S., of Cardiff, and he and Mr. Gerald N. Marks have both submitted reports upon the project. In that of the first-named expert, he states that no coking coal known to him in England or on the Continent gives so large a percentage of "volatile bye-products, and at the same time produces so much good, hard, silvery coke," as that with which the Company propose to deal. Many coals give a higher percentage of coke, but yield a much smaller quantity of residuals. Practical tests of samples of coal from two of the collieries in New South Wales from which the Company will be supplied (Greta and the Australian Agricultural Company's Hebburn) gave the following results:

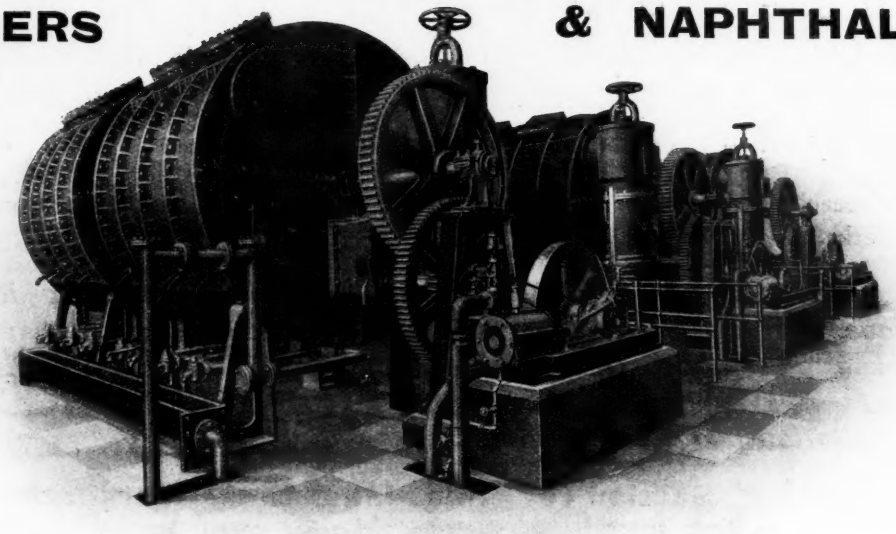
	Greta.		Hebburn.
Coke	63·81	..	67·49
Tar	5·92	..	6·10
Sulphate of ammonia	1·80	..	1·85

Professor Galloway puts the value of these products per ton of coal at 16s. 11d., against 15s. 1d. in England. Ammoniacal liquor can be sold in Australia at 4d. per 100 oz. of 8 oz. strength f.o.b. at the works; and this in the case of the above-mentioned coals represents 2s. 11d. per ton of coal coked. As the Company will be dealing with 95,000 tons of washed coal per annum, the ammoniacal liquor would represent £13,854.

Professor Galloway estimates the cost of the works and plant at £62,000, and the revenue at £80,979—viz., coke, at 17s. 6d. per ton, £55,250; tar, at 3d. per gallon, £11,875; and ammoniacal liquor, at 2s. 11d. per ton of coal, £13,854. Deducting from the total revenue the cost of coal, labour, &c., put at £52,941, there is shown an annual profit of £28,038.

EFFICIENT WASHING PLANT.

HOLMES' WASHERS FOR AMMONIA & NAPHTHALENE.



An Installation at a Colonial Gas-Works—including Two Repeat Orders.

TOTAL CAPACITY, 7,500,000 Cub. Ft. per Day.

W. C. HOLMES & CO., LTD., *Sole Makers,* **HUDDERSFIELD.**

GAS COOKERS AND PARTS

ENAMELLED CROWN PLATES AND LININGS.

A GAS ENGINEER WRITES: *"Your Gas Stove Burners and Deflectors have more than double the life of those supplied us by other Makers."*

We can make your Stove Department show a big increase in profit.

Send us Trial Order for:—Burners and Deflectors, with Samples.

Telegrams: "AMOUR, LONDON."
Telephone Nos.: 1890 HOLBORN CENTRAL 194.

A. G. CLOAKE,
54, HOLBORN VIADUCT, LONDON, E.C.

ECONOMICAL GAS APPARATUS CONSTRUCTION

MERRIFIELD-WESTCOTT-PEARSON PATENTS.

WATER-GAS PLANTS COMPANY, LTD.

19, ABINGDON STREET, WESTMINSTER, S.W.

Telephone: VICTORIA 39.
Telegrams: "CARBURETED, LONDON."

"VICTOR" GAS BOILERS.

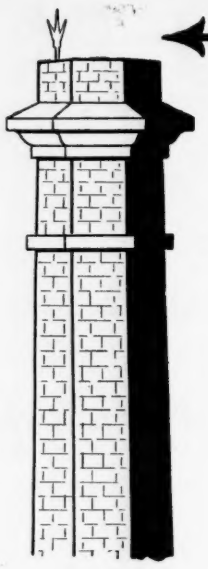
It is generally known to the Gas Industry that the Society of Medical Officers of Health—a Society which is the highest in the land so far as health matters are concerned—has given up the use of Electricity at its Headquarters in favour of Gas.

In a speech, as reported in "Public Health," the Chairman of the Committee of the Society remarked:—

> *"No Member who had experience of their Meeting Room under the old conditions could deny the improvement that had taken place since Gas had been substituted for Electric Light, and* ***THE NEW SYSTEM OF HEATING*** *and ventilation had been installed."*

The Heating Section of this important installation is one of the numerous special undertakings we have had for the Gaslight and Coke Company, where *OUR* Boilers have once more proved themselves THE "VICTORS."

THOMAS POTTERTON, *Heating Engineer,* CAVENDISH WORKS, **BALHAM, S.W.**



IMPORTANT!

NO WASTE UP THERE WITH

BROOKE'S PATENT REGENERATORS.

SOLE AGENTS: **ROBERT DEMPSTER & SONS, LTD., ELLAND.**

ILLUSTRATIONS & DESCRIPTIVE SPECIFICATION WILL BE SENT ON APPLICATION.

COAL-LIMING AT THE CHELTENHAM GAS-WORKS.

An Effective and Economic Process—Investigation into Experiences.

"CHELTENHAM must give the answer." Those were the words with which, on May 30 last, an editorial comment concluded on the revival of coal-liming at the Cheltenham Gas-Works. The preceding words were: "Have Mr. Paterson and Mr. Twycross solved, through simple means, the riddle that was left unsolved more than a quarter of a century ago? The system was then found wanting. Is it so no longer?" Then followed the words "Cheltenham must give the answer." Mr. Paterson's reply "Come and see" was characteristically modest and affable. We have complied, and, what is of more importance to the gas industry, have Mr. Paterson's permission to make full and unfettered use of the information gathered by personal observation, and by consulting the daily carbonizing and other working records. The liberty granted, we will make use of, by presenting the results of the investigation in style both free and plain.

The first surprise was, so quietly had the patentees been working, that—at the time of the publication of the patent specification of Mr. R. O. Paterson and Mr. Lionel E. Twycross, for "The Preparation of Charges of Limed Coal for Distillation in Gas-Retorts, and in Apparatus for Use in the Said Preparation"—the process had been in actual and unintermittent operation for a full twelvemonth; and, as a matter of fact, from May 11, 1910, to Sept. 30 of this year, of the 48,072 tons of coal carbonized for the gas supply of Cheltenham, there has not been a single pound that has not been subject to liming prior to carbonization, with relief from the excess of sulphur compounds that was experienced subsequent to the abolition of lime purification on the old system in 1907, with relief from the complaints that arose in the town, without any return to the nuisance that attended lime purification after the old fashion, and without the worry of finding a place to dispose of the spent lime. Moreover, as between coal-liming as practised to-day at Cheltenham and the old system of lime purification, there are marked economy and greater beneficial effects. The economic side and the effects are palpable, and these are the main things for a commercial industry. An explanation, however, as to the cause or causes of certain of these effects is more difficult, but that is a matter that leans to the academic side rather than to the practical and economic, and so can be left for future inquiry by those whose interest may be aroused.

SECRET OF SUCCESS WHERE OTHERS FAILED.

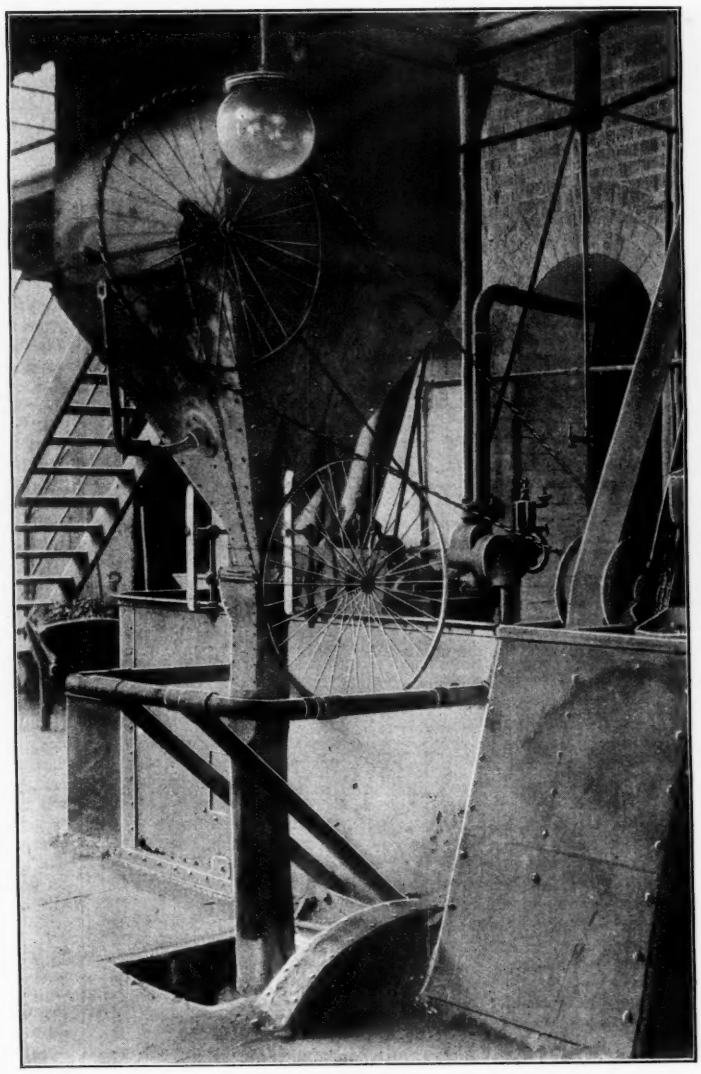
Mr. Paterson and Mr. Twycross have achieved a practical and effective success, where Mr. Cooper and his co-workers—Messrs. Spice and Wanklyn—failed in the eighties; and there is no doubt that the bridge from non-success to success was entirely discovered in the method of application and preparation of the charges. Crudity was found wanting; success attends a simply practical but scientific application of the lime to the coal, whereby every nodule has its lustrous black surface coated to a sufficient extent, by the ground yellow lime used, to turn it to a dull-tinted brown by the means taken to cause a definite adhesion of the lime dust. No particle of coal escapes treatment; there being by this process uniform application, in place of the irregular one in the days of Cooper. Yet each piece of coal only looks as though it has been dusted with the lime—nothing more. In this uniform or precise process of application, however, is found the secret of success.

THE APPARATUS EMPLOYED.

At the Cheltenham Gas-Works, two sets of the apparatus have been installed for dealing with the coal on its passage from the coal-stores into the two retort-houses; and when the new section of works which is now in course of construction is brought into use, it will certainly be found that there the process has also been applied. In fact, Mr. Paterson cannot now afford to be without it, unless he desires to have the gas consumers again protesting against the sulphury condition of the gas supplied to them. But sufficient for our present purpose are the installations and experiences of to-day.

POWDERING AND SCREENING THE LIME.

Common to both sets of apparatus is an ordinary roll or contractors' mortar mill (which, by the way, is not kept specially for this one purpose); and this mill only requires a small amount of power to drive it—a small vertical steam-engine being used in this instance. When a fresh supply of ground lime is required, the attendant simply throws into the pan of the mill a quantity of the rough shell lime, and after it is ground up, he transfers it to a special form of riddle, for the design of which Mr. Twycross takes the honour. The special object of its design is to prevent the lime dust flying about and being wasted. It is in the form of a circular pan, with a thickly-perforated bottom; and the screen is partitioned by means of a spiral of hoop iron—something like an enormous clock mainspring—with, in each channel-way thus formed, checks or baffles, so as to prevent any large accumulation of lime nuts. It will be understood that only lime dust under this process is required, and not nuts. But by means of this construction of riddle, not only is flying dust and waste prevented, but by the trituration of the small pieces set up by the revolving spiral, and the provision taken to prevent anything but a small accumulation of the lime in any part of the screen, practically the whole of the lime transferred from the mill to the screen is reduced to the finest of powder. This falls into a store beneath the screen. The store is enclosed, also for the purpose of preventing flying dust and waste, which would otherwise be large with the mechanical screen setting up air-currents above. The rough lime, by-the-by, that is not reduced to powder travels by the spiral course to the centre of the screen where it finds exit apart from the lime-dust, and these lumps are again transferred to the mill. The screening is a rapid and effective process, though the screen itself is home-made. The one now in use is not the original one. The predecessor was found too small. But it was seen and examined; and though it had dealt with some 600 tons of lime before being superseded, there is no trace of wear or tear upon it. And this is an impression that is applicable to the whole of the apparatus employed—that, from first to last, there is nothing to get out of order, and that the question of maintenance and repair will be of insignificant character. This, in fact, is a point that, with close upon eighteen months' constant work, has not so much as occasioned any thought at Cheltenham.

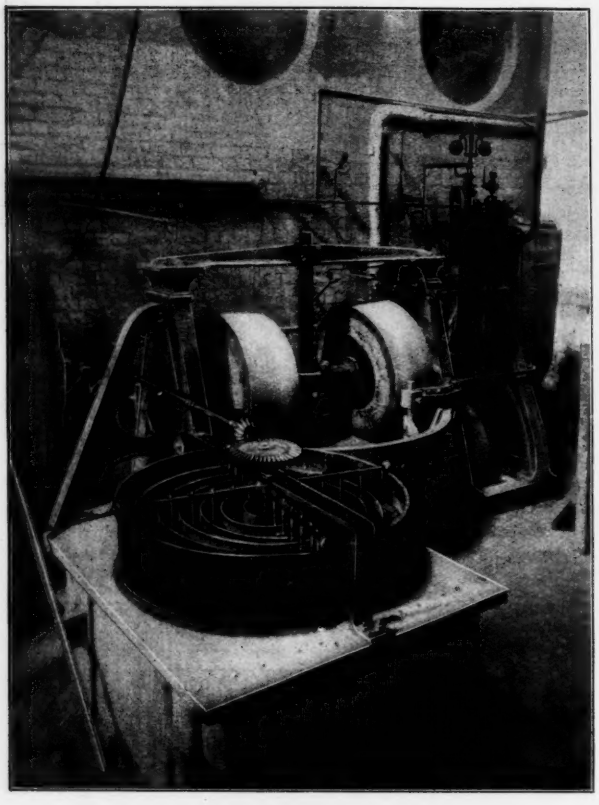


One of the Liming Hoppers and Shoots.

PREPARING THE CHARGES OF LIMED COAL.

The point is emphasized by the simplicity of the apparatus used for preparing the charges of coal, and for producing the effect of —not admixture, but coating the coal. The installations in both coal-stores are similar; and therefore we will confine our description to the one applied to No. 2 house. There is first the overhead hopper with a tapered end, each hopper (though comparatively

small in dimensions) having a capacity of 2 tons 3 cwt. of powdered lime. The lime is raised to the hopper by a small elevator enclosed in Mannesmann tubes; the elevator itself consisting simply of a belt, carrying tin buckets made by the works' tinsmith. An inclined tube shoot delivers the lime from the top of the elevator into the hopper. The hopper in No. 1 house, it may be incidentally remarked, is fed by overhead waggons running across the coal-stores. A mechanical tapper is provided to prevent the lime clogging in the tapered bottom of the hopper. This tapper is furnished with a special projection on which to strike; and it performs its function with monotonous regularity, but with the utmost efficiency. Another important contributor to success, and to a range of application according to the necessities occasioned by the character of the coal, is the means provided for regulating the quantity of lime applied. At the outlet end of the tapered part of the hopper is a roller, which is adjustable in relation to the outlet, or the speed of which can be regulated, both with the same purpose of controlling the quantity of lime passing to the coal. Below the outlet end of the tapered part of the hopper is a flexible pipe extension, so that the lime is delivered immediately on to the top of the coal, and is prevented from being scattered by draughts or by the disturbance occasioned by the coalmen and their operations. Further details of the apparatus can be obtained from the description that we published from the patent specification on May 23 last (p. 530).



The Revolving Spiral Riddle for Screening the Lime.

(Mill used for grinding the Lime in the Background.)

In the case of both houses, the apparatus is elevated above the inlet to the coal-breaker, and as the men shovel in the coal, so the powdered lime drops into the midst of it from the flexible shoot. There is no chance for it to escape. If one rescues pieces of the coal before it reaches the breaker, it is found that they have received a thorough lime dusting, which is easily blown off; and therefore, without further treatment, by the time the coal was dealt with by the West manual stokers used at Cheltenham, the lime coating would have disappeared. Here we have the next stage in the preparation. Between the rollers of the coal-breaker, a small jet distributes steam thoroughly in and among the coal; and this causes the lime to cohere to the coal surfaces sufficiently to obviate it being blown or shaken off in transit to the overhead coal-hoppers in the retort-house, in which hoppers further steam is distributed in order to complete the fixing of the lime. That it does stably adhere to the coal is seen by the changed appearance of the coal itself in the scoop of the charger, as well as by the facts that there is no lime dust about the place, and that there are no accumulations of lime found between the coal-breaker and the scoops of the manual machines. Besides there are the effects, which started with the day the process was brought into use, and which have continued without interruption since. Coal-liming is the only radical change that has been made in the working, and that change is simplicity itself.

The Results.

Close upon eighteen months' continuous working is a crucial and ample test. The process is regarded to-day as an indispensable part of the working. In comparing the results, a better course cannot be taken than to make comparison of the June half year of 1910 and the six months ending with June last. It is true the process was started on May 11, 1910; so that that half year obtains some partial advantage from the few weeks during which the coal-liming was in operation. But, on the other hand, the advantage was not at high-water mark, in view of the fact that the process was then put into use, as it were, tentatively; it being necessary to feel the way, especially in order to watch narrowly for the appearance of any detrimental effect on the coke. Consequently, the percentage of lime was at first low. It was gradually augmented until the grains of sulphur were brought down within reasonable and permissible limits. At the point of use ultimately determined upon, there has not been found any detrimental effect upon the coke. More on this point presently. But the carbonizing book presents us with the tale of this gradual increase of the percentage of lime, of the gradual reduction of the sulphur compounds, of an improvement in the illuminating power of the gas, of an increase in the production of gas per ton of coal carbonized, and of relief from stopped ascension-pipes. Some of these are changes that commenced to accrue from the day the process was introduced as part of the working; the increased production of gas was a result of the power in the matter of temperatures given by the elimination of stopped pipes. The wherefore of some of the effects is not, as previously said, such an easy matter to explain as it is to state the bare facts. We will refer to the points with a little more fulness later on; but they will at this stage arouse curiosity.

Meanwhile, there is the comparison between the June half of 1910, and the June half of this year; but readers must bear in mind what has already been said about the last six weeks or so of the first period. In the June half of 1910, 19,556 tons of coal were carbonized, from which 245,673,000 cubic feet of (average) 14·76-candle gas was made—the average production per ton being 12,562 cubic feet. The illuminating power is tested three times daily by the "Metropolitan" No. 2 burner. In the June half of 1911, 18,921 tons of coal were carbonized; the production being (though less coal was carbonized) 253,678,000 cubic feet of 14·98-candle gas—the average production being 13,407 cubic feet per ton. This production per ton of part Derbyshire and part South Yorkshire coal will cause some interest, in view of rival claimants to distinguished merit in this regard—this production being with stop-end retorts, manual machinery, and light charges, though heavier ones are contemplated in the new section of works. But the 13,407 cubic feet is an increase of 845 cubic feet—compared with the half year when the lightest six weeks only had the coal-liming process in experimental use. The increased yield per ton brought the half-year's production to upwards of 8 million cubic feet more than that of the June half of 1910, though 635 tons less coal were carbonized. The economic side of coal-liming has only been divulged by experience in attempting something to obtain relief from the excess of sulphur compounds; and, as to this capital purpose, we find that the average amount of sulphur compounds per 100 cubic feet of gas in the June half of 1910 was 36·87 grains as compared with 20·48 grains last half year—a reduction of 16·39 grains, taking no account of the advantage on the average of the first half year of the reduction made during the final six weeks when coal-liming had been applied. Prior to that, we remark from the records, the average sulphur content of the gas distributed was 40 grains, and sometimes rather more. In these figures is the full justification for coal-liming under the Cheltenham method—particularly in such a residential town.

Coal-Liming and Lime Purification.

In the half year ending June last, the quantity of lime used for coal-liming was 340 tons 11 cwt., or equal to 1·79 per cent. of the coal carbonized. Now, if we take a complete year in which lime was employed entirely for purification in the ordinary way, it is found that in 1904 the quantity used was equal to 3·71 per cent. of the coal carbonized, which is rather more than double the quantity employed for coal-liming. Again, we may take 1905, when the percentage of lime used to coal carbonization was 3·77. But, of course, there is now the oxide purification to add to the coal-liming. Anyway, if we add together the percentages of lime used in 1904 and 1905, and divide by two, in order to obtain a fair average, we arrive at 3·74 per cent., which shows a saving of lime by coal-liming of 1·90 per cent.

Benefits—Financial and Otherwise.

It has to be confessed that it is rather difficult to assess the value of the coal-liming process as practised at Cheltenham. It will be recognized that there are several disturbing factors that come in, in attempting to obtain something like an acceptable balance-sheet; and such a valuation requires very careful study. On the one side we have the main fact of a reduction by nearly 50 per cent. of the quantity of sulphur compounds; and purity of gas is something that is desirable and of value. There is also the freedom from the nuisance that obtained prior to the sulphur clauses being abrogated; there is further the freedom from the difficulty of finding a tip for the spent lime. There came the increase—and the sustained increase—in the volume of gas made per ton, and the fractional improvement in the illuminating

power, owing to the new freedom from stopped pipes and to the road being opened for higher temperatures.

On the other hand, we have as a definite charge the cost of the ground lime, which during the six months ending June last, was 2·79d. per ton of coal carbonized; and the labour cost 0·68d. So that the cost of coal-liming—lime, grinding, screening, and labour—in the half year was 3·47d. per ton of coal carbonized. But this 3·47d. could be reduced with new plant—with a proper roll mill, with larger lime hoppers, and when applied on a larger scale. While, however, this cost has to be added to the cost of coal, on the other hand, the fact that the sulphur compounds can be dealt with in this way broadens the market in the matter of the selection of the coals available for use. Against the coal-liming, we have the improvement in the carbonizing results that has occurred since coal-liming started. Supposing we take the 845 cubic feet realized per ton of coal carbonized at the current price of gas in Cheltenham (less discount)—that is to say, 1s. 11¾d.—per 1000 cubic feet, its value is 1s. 8d. From this there falls to be deducted 0·42d. at ¼d. per 1000 cubic feet for purifying, and 4 per cent. of unaccounted-for gas, valued at 0·78d. When these deductions are made, we get a net value of the extra gas produced of 18·80d. per ton of coal; and this must, as will be shown, be placed to the credit of coal-liming.

No Stopped Pipes and Less Carboning-up of Retorts.

There is this further fact that, since coal-liming has been in use, there have been no stopped pipes—they have been kept perfectly clean. There, again, what is the connection between coal-liming and freedom from stopped pipes? The practical fact and advantage will be appreciated by every gas-maker. But the money value of freedom from stopped pipes is not very ascertainable. At the same time, one has maintained a clear condition in the ascension-pipes, which enables the gas to leave the retorts freely. This being so, the result has been at Cheltenham that they have been able to raise the carbonizing temperatures which was not possible before the coal-liming process was introduced, owing to stopped pipes. The heats were raised; and the result has been an increased volume of gas per ton of coal—an average last half-year of 13,407 cubic feet, of nearly ¼-candle higher illuminating power. Therefore credit is given to the coal-liming for this.

The carboning-up of the retorts has also been reduced—very considerably so—since the coal was limed; but no explanation can be given as to the reason. The fact, however, is indisputable; and the retort-house hands bear witness to it. They also bear witness to the freedom from stopped pipes; and there is one practical experience which demonstrates and proves the point. There is a retort in one of the settings which has sunk considerably—so much so that the charging-machine cannot deal with it. Consequently this retort had to be charged by hand. When the liming process came into operation, the retort was charged in the usual way with unlimed coal. But though the retort had this individual attention, the ascension-pipe had the bad grace every charge to stop-up. The lid had to be opened, and the augur applied in this one instance—all the other ascensions keeping totally free. The men then of their own initiative tried the effect of throwing a little lime on to the coal before charging this recalcitrant retort. The trouble ceased; and the men have not since neglected to lime the coal required for the retort. This was a striking object-lesson; and, in connection with it, readers may be reminded that at Cheltenham dry hydraulic mains are the vogue.

Production of Ammonia.

Inquiry was made as to the effect upon the production of ammonia. That there was an increase due to the use of coal-liming was a claim made by the experimenters in crude form nearly thirty years ago; and during the first six months' working at Cheltenham with coal-liming, there was an actual increase in the quantity of ammonia, and a slight increase in that of tar. Since then heats have been raised; and at present, Mr. Paterson is not prepared to say that there is any increase on the prior working. There is, however, the gas-yield compensation derived from the ability to now employ higher heats in view of the maintenance of clear ascension-pipes. Of course, if the lower heats of former times were maintained, there would undoubtedly be an increase in the ammonia and tar; but this has been neutralized by the higher temperature of distillation. Yet the heats at Cheltenham are not phenomenally high. But, notwithstanding, we are faced with this high average production of 13,407 cubic feet of gas per ton during the first half of the present year.

Limed Coke.

There was great controversy between two and three decades ago as to the effect of coal-liming upon the coke. Generally from the Cheltenham experience, under the process of Messrs. Paterson and Twycross, it may be taken that the coke of limed coal is by no means inferior to that of unlimed coal. On the contrary, it is believed that, as a fuel, it is a superior article. No claim is made on this score by Mr. Paterson and Mr. Twycross; but when the claims under their invention was under investigation by the Patent Office, the patent of the process, known as the "Diehl-Faber," for the elimination of sulphur from fuels and metals was brought to light. From a pamphlet describing this process, we make the following extract, which is highly interesting in view of the matter under consideration:

> The "Diehl-Faber" process . . . will also prove to be of special value to owners of coal mines and coking plants, inasmuch as they will be able to produce a smelting coke from highly sulphury coal, which will, in the blast-furnace, as well as in the cupola, give better results than the very highest qualities of coke with low sulphur contents, such as Durham coke and the like. To obtain this result, the coal for coking is prepared in the usual way for coking in bye-product ovens—namely, by grinding—and, if necessary, washing; but before stamping it for the coking, so much powdered lime or limestone is added that the silica present in the ash constituents is transformed into a mono-silicate. In cases of very sulphury coal, the quantity of lime added may be proportionately increased. The mixture thus obtained is introduced and baked in the coke-oven at a high temperature—if possible, at a temperature not less than 1300° C. The basic silicate formed by the action of the lime on the ash acts upon the sulphides present in the coal, and binds the sulphur in the form of calcium sulphide. The cost of the special preparation of the coke will be greatly outweighed by the advantages gained—(1) In the production of an iron low in sulphur by using the specially prepared coke for smelting; (2) by the economy in fuel; and (3) by the possibility of using any sulphury coal, and still obtaining better results than with the best qualities of coke now obtainable.

Here we have a case of an actual application of lime in the carbonization of coal for the express purpose of producing a coke for use in iron smelting to yield an iron containing less sulphur than by using coke produced without the addition of lime. One of the economic advantages claimed for this is that coal for the production of metallurgical coke may be used, under the process, that beforetimes it was inadmissible to employ on account of the high sulphur content. Mr. Paterson believes there is a distinct (though perhaps it is not easy to assess it) advantage to coke produced from the limed coal compared with that from unlimed coal. Although it may contain an additional percentage of ash, it is by no means an inferior heating coke to that from unlimed coal. Herein is an interesting matter for future consideration. The coke itself in general appearance and physical characteristics does not present anything that enables one to distinguish it from ordinary coke; but there is one curious thing. It is this—that in screening the coke the dust—not the large or the breeze—seems to contain a large percentage of sulphur. If a shovelful is picked up as the dust leaves the screen, it is quite warm to the hand. In the days long since, Mr. Cooper claimed that on combustion, coke from coal limed under his crude process gave off no sulphury smell. That was regarded as a singular claim. Mr. Paterson at the time personally tested the matter, with the result that he could substantiate the claim. All the coke produced at the Cheltenham Gas-Works is being sold in the town at the present time; and there have not been any abnormal number of complaints regarding the coke since coal-liming was introduced. There is the experience, too, within the gas-works themselves. The coke is used for the furnaces of the retort-settings; and in repairing them nothing has been found on the brick or iron work that is in any way exceptional. The only thing is that a little more ash has been found in the flues. From these experiences, it appears to be safe to say that, using the percentage of lime as at Cheltenham there is no detrimental effect on the coke.

Miscellaneous Notes.

The coal-liming process must also have some effect on the sulphuretted hydrogen; but oxide nowadays runs for such a long period that it is impossible to assign any particular benefit to the oxide purifiers through the liming of the coal. The predominant aim of the process is to reduce the sulphur compounds, and when it is seen from the works' records that, before the introduction of the system of coal-liming, it was a common thing for the sulphur compounds to be pretty constantly in the upper neighbourhood of 40 grains per 100 cubic feet, while, in the half year to June '30 last, they were only just over 20 grains, and have been so since, then it is correct to say that the chief object has been fully accomplished, and that by the use of only about 1·75 per cent. of lime. Experience teaches us that gas containing (say) 25 grains of sulphur compounds will not, on combustion in private houses, be recognized as sulphury gas. As to the percentage of lime used, the carbonizing books show that never has the maximum quantity applied reached as high as 2½ per cent. Mr. Paterson has been guarding against this in order to keep free from trouble with the coke—in fact, we find that at Cheltenham, when carbonizing coals fairly high in sulphur, with the use of 2 per cent. of lime, there has been no difficulty in keeping the sulphur down to a low figure. As to the lime employed, no particular class is favoured. Derbyshire, Welsh, and hydraulic Lias limes have been tried; but in all cases the results were much the same. Now oolite lime is being used, simply because it is nearest at hand.

The system, it is understood, is likely to be put under test on a larger scale at other works. And we shall not be surprised, after this record of the experiences at Cheltenham, to hear of an extended trial at several places.

For facilities afforded to investigate the system and working, for assistance rendered and information given by Mr. Paterson and his chief assistant (Mr. James Paterson), and for permission to publish the results of the inquiry, we have to express our acknowledgments.

Midland Association of Gas Engineers and Managers.—We learn from the Hon. Secretary (Mr. Harold E. Copp, of West Bromwich) that the autumn general meeting of the Association will be held at Birmingham, on Thursday, the 26th inst.

MODERN GAS-FIRES.

We give below particulars of the new gas-fires which Messrs. R. & A. Main, Limited, have brought out for the present season. In inviting attention to them, Messrs. Main wrote as follows:

The close observer will have noticed that all the gas-fires brought out for the new season have a tendency to conform to a certain type; and a glance through the latest fire-lists will confirm the correctness of his observation. To deal first of all with the new type of shallow fire, it will be found that in practically all the latest patterns the plain surface design has been adopted, which can be elaborated with brass beadings and ornaments when required.

So far with regard to the external design. An examination of the integral parts will show that alterations and modifications have been made which have had the effect of bringing hitherto diverse features to a striking pitch of similarity. Take the fuel. It will be noticed that this is being lengthened, though there is still in some cases an unsightly expanse of dull brick visible under the canopy. The fuel has also in other cases been made to fit the flame—tapering towards the top in order to effect this. The back of the fuel is being made solid, or almost so; and each pillar is held in position over a burner nozzle by clips top and bottom. The inside surface of the fuel is designed with small projections, so as to give greater contact with the flame. Extreme fragility, the result of sacrificing every other consideration for the sake of obtaining excessive incandescence in an unreasonably short space of time, is a grave defect which is being overcome by a tendency to use a fuel very much stronger in structure. The fire itself is now made in one casting, or two castings at most. There is also an apparent effort to simplify construction by reducing the number of loose parts, and by fitting as far as possible without the use of screws. The introduction of new complications is a matter to be deprecated on the score of cost, maintenance, &c.; and clumsy duplex taps, which incorporate governors or other regulators in most unsuitable positions, are to be avoided.

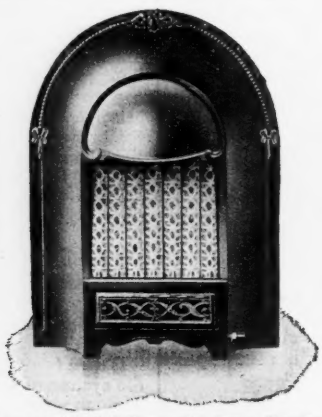
Naturally, the questions will be asked: What is the reason for this growing uniformity, and what is the model to which the various makes of fires have now so close a resemblance? The answer to the first point will be found in the spirit of emulation (to give it no other name) which characterizes the gas-stove industry at the present day. Any new fire which, by reason of a higher efficiency or greater novelty than has hitherto obtained, is the exceptional success of a season, is at once made the model which rival manufacturers strive to equal or surpass. Anyone who has had experience with Messrs. R. & A. Main's "D.S.O." series of gas-fires will be able to recognize the model which has thus been honoured, and answer the second point, as all the features which were introduced by the firm last season have been extensively copied. A perusal of the article dealing with Messrs. R. & A. Main's gas-fires which appeared in the "Journal" at the beginning of last season will prove the fact that the features therein set forth as peculiar to the "D.S.O." series are now the "new" features of this season's fires in other series, which, however, do not yet attain to the extreme simplicity of construction and great efficiency of their model.

With the foresight of experience, Messrs. Main have anticipated the levelling-up process, above referred to, and have created a new series of "D.S.O." fires, embodying several improvements and refinements, which mark a further step along the road to perfection, though, for reasons which will be obvious to the shrewd reader, they have delayed publication of particulars up till now.

Before giving details of the new series, which will be known as the "Mark II.," and listed at slightly higher prices, it should be pointed out that as the original series, which will be known as the "Mark I.," have made so many friends, it has been decided to continue to manufacture and supply these to those clients who require them.

Now as to the "Mark II." series. These will be made in no less than five sizes—8, 10, 12, 14, and 16 inches. These are the nominal sizes, the actual ones being 7, 9½, 12½, 15, and 18 inches. The introduction of up-to-date gas-fires in such a small size as 8 inches will, it is expected, give a fillip to the heating of small rooms by gas. The external design of the original series of "D.S.O." fires will be followed. A notable point in the construction of the new series is that the fronts are detachable and interchangeable, so that a round pattern fire can be converted, *in situ*, into a square pattern one, or *vice versâ*, and without the use of special parts.

"Dependable" Fire, with Brass Beading.



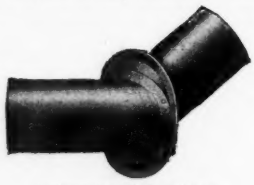
"Symmetrical" Fire, with Brass Beading.

"Original" Fire, with Ornaments.

A new burner has been invented with an improved mixing-chamber which ensures more perfect combustion and a higher efficiency. The inside of the burner has been specially treated to render the surface perfectly smooth; thus ensuring silence in action. The burner is, of course, reversible and interchangeable. This feature will be referred to more fully later.

A novel and effective gas and air regulator will be fitted to the "D.S.O." and other new pattern fires, particulars of which are given below. Instead of the gas being controlled by a nipple regulating the volume at the mouth of the injector, it is controlled by a valve-shaped arrangement in the body; leaving the actual injector holes a constant size, and so maintaining a uniform mixture at whatever pressure—the height of the flame being regulated by the ordinary cock. This arrangement is also conducive to silence. The air-adjusting disc is protected by the fender (which, by the way, can be fitted or removed without the use of screws or nuts). The gas-adjuster is outside the fender, and is fitted with a lock-nut, so that once the fire is fixed and correctly adjusted, the curious hands of the ignorant will be unable to alter it. Another advantage is that neither the gas nor the air adjustment can be inadvertently shifted in the process of cleaning or in other domestic upheavals. If preferred, smaller injectors are fitted, in which the gas adjustment cannot be made from the outside of the fire. The back brick is in two halves, to allow for expansion and for greater ease in handling. No screws or fastenings are necessary to keep this brick in position.

The fuel has been slightly modified in construction, with the idea of giving a cheerful "live" appearance and increasing the radiating efficiency. The new fuel is similar to the older type in that it extends right from the nozzles of the burner to the canopy. It is important to note, with regard to this point, that to get fires fitted with short fuel perfectly incandescent, more heat must be wasted than in fires with longer fuel, in which the maximum heat is utilized. The back is practically solid. The openings in it are invisible, being cut in the material diagonal-wise—thus ensuring perfect aëration without in any way detracting from the appearance. The fuel, as in the original series, leans back slightly off the perpendicular, as it has been found that this position gives a much larger radiating radius; the heat being directed up and into the room instead of to the floor, to the detriment of the floor covering. This also does away with the necessity for a reflector to reflect the heat upwards. As a further aid to upward radiation, the top portion of the fuel has been curved. Each pillar of fuel, which is slightly tapered, as last year, in order to fit the flame, is held over its burner-nozzle by fuel-holders both top and bottom. There is therefore no danger of the fuel falling out, and no necessity for fire-bars, which obstruct radiation, though guards can be supplied as hitherto, if required. It should be here pointed out that the fender, burner, brick, fuel, and fuel-holder are all removable without the use of any screws or fastenings.



Adjustable Flue Elbow.

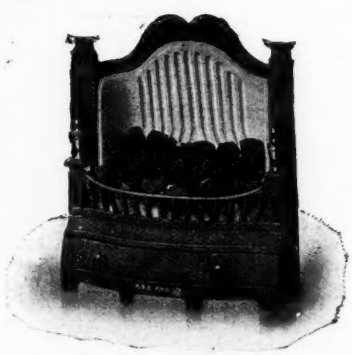
To enable the "D.S.O." fires to be adaptable as far as possible to any local conditions, it has been arranged to supply them with either sloping or horizontal flue outlets. An adjustable flue elbow

has also been invented and patented through which the products of combustion can be conducted at any required angle. The illustration of this contrivance will convey a sufficient idea of its utility and economy in fitting gas-fire flues.

A modification of the "D.S.O." is the "Adaptable." This is to all intents and purposes a "D.S.O." fire-burner fitting for use in an ordinary register grate. The advantage of this fire is that it is not necessary to remove the bottom bars of the interior before fitting. A special canopy may be supplied, if required, with the "Adaptable" fire, forming an integral part both of it and the coal-grate, and entirely transforming the latter into a gas-fire without any fitting.

"Adaptable" Fire.

We now come to the consideration of the "St. Nicholas" fire, which represents the first attempt to fit a thoroughly efficient gas-fire into an ordinary register grate. As in the case of the "D.S.O." series, it has been decided to continue last year's type of "St. Nicholas" fires. These will be known as the "Mark I." series, and the new "St. Nicholas" will be known as the "Mark II." series. The latter are fitted with a new burner embodying the same features and improvements as are mentioned above in the description of the new "D.S.O." series. The foundation white fuel has been modified in order to still further simplify fitting. An important point about the new fuel is that it is telescopic, being adjustable in length, so that there is no necessity to break off portions in order to get it to exactly fit any grate. There is one piece of the new fuel to each nozzle of the burner. It is semi-circular in shape, and lies exactly over a groove in the bottom brick. The flame from the nozzle of the burner is directed along the channel thus formed; the final effect being much the same as in the upright fuel of the ordinary gas-fire. The now familiar lumps of black fuel, which give the finishing touch to the appearance of this fire, are laid on the top of the white fuel as hitherto. But Messrs. Main have introduced this season a new type of cinder fuel, in order to render the fire still more similar in appearance to a coal-fire; and this will be supplied when required. The under side of the bottom brick is deeply grooved, so that pieces may be broken off easily to enable the brick to fit the grate exactly.



The "Santa Claus" Fire.

[A "St. Nicholas" Fire with a Self-Setting Frame.]

A further development of the "St Nicholas" fire is seen in the illustration of the "Santa Claus" fire, which explains itself. An important point about this fire is that it is self-setting, and it is not necessary to remove the bottom bars of the existing interior when fitting. As in the case of the "Adaptable," a special canopy can be supplied for converting the existing interior *in situ* into a complete gas-fire.

Messrs. Main have not lost sight of the importance of interchangeability. All the fittings of the "D.S.O." series are interchangeable with the "Adaptable" series, and the fittings of the "St. Nicholas" are interchangeable with the "Santa Claus." As mentioned above, all these fires will be fitted with the new pattern injector.

All the new fires specified, or any of the old ones, can be finished in art black, Berlin black, or any colour of enamel. In this connection, it may be stated that a large and well-equipped enamelling shop, under expert supervision, has been opened at the Edmonton works of the firm. This, together with the enlarged enamelling shop at their Falkirk works, will enable them to cope with the increasing demand for their fires in special enamel finishes.

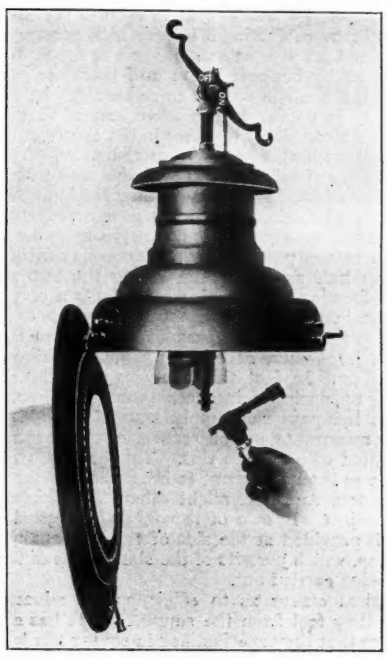
Attention may be directed to the "St. Mungo" and "St. Magnus" radiators. Messrs. Main claim that these are the only radiators having an automatic gas-regulator that is absolutely safe and certain in action. The growing success of these radiators has led the firm to add several larger sizes to their series.

It will be seen from what has been said that Messrs. Main have spared no expense to secure the success of their fires; but they feel that the outlay will be justified. To give a paraphrased quotation which appeared in these columns lately: "They have cast their bread upon the waters while the tide is coming in."

THE "A TO Z" INVERTED LAMP.

High Power at Low Pressure.

BEFORE proceeding to enumerate some of the main features—and they are features deserving of consideration—of the new patent "A to *Z*" inverted gas-lamp, it may not be out of place to explain the reason for the, at first sight, somewhat curious name that has been bestowed upon it. Briefly, it is so called because the makers suggest that the practical details in its construction cover the points required by the maintenance departments of gas undertakings who supply lamps of this character and enter into contracts to keep them in a state of efficiency. Simplicity of construction and easy access to all the different parts are the main



The "A to Z" Lamp, with Inner Glass Cylinders.

[Showing Removal of Loose-Fitting Burner.]

objects aimed at—and successfully attained, be it said—in the design of this lamp, which is being manufactured by the Inverted Gas-Lamp (Ferguson's Patent) and Fittings Company, Limited, No. 43a, Carlisle Street, Marylebone, N.W. That these points are of importance in connection with appliances which are fixed under maintenance arrangements—and, indeed, under any conditions—will be admitted. Lamps which are difficult to get at for purposes of cleaning or the renewal of parts, occupy a greater amount of a man's time than do those so designed that the different portions are readily get-at-able, and without calling for the exercise of any particular skill.

The large outdoor "A to *Z*" lamps are of two types—*i.e.*, with inner glass cylinders, and without; and they are made for one, two, three, and four lights. The outer case, which is in either copper oxidized finish or steel enamelled, is in three parts—the top canopy, the chimney section, and the bottom section. This, of course, allows of the renewal of any one portion, should it be necessary, without the "scrapping" of the whole of the case. The copper pattern appeals particularly to the eye; and, in passing, it may be remarked that the lamps are of English make, and are well and substantially made. But "Simplicity and Easy Access" are the watchwords; so attention shall be at once fixed on these points. Let us take a lamp with inner glass cylinders, as illustrated, and see with how little effort it can be taken to pieces. By doing so, the principles of its construction will be understood. The first step is indicated in the photograph—to unfasten the catch of the reflector which carries the globe, and allow it to fall open upon its hinge. This brings us into touch with the reflector over the burners, which is not made as part of the inner

flue, but is a separate piece; and the method of removing it is by simply unscrewing the bottom of the bye-pass, which extends to beneath the burners. The extension-piece leading down from the bye-pass gas-chamber (which will be referred to presently), has a flat side, which acts as a guide, and at the same time it forms the bye-pass gas supply. Over this there is a sliding tube, also with a flat side; and to this the reflector plate is attached. The guide enables the reflector, which carries the glass cylinders, to be placed in position or withdrawn without any possibility of the cylinders touching the mantles. Though, however, the effort called for in withdrawing the reflector is so slight, the glasses and the burners can be removed without taking even this small amount of trouble.

The burners are of a special angle type, in heavy cast brass. They carry the usual standard nozzles, mantles, and glasses, and can be lifted out of the lamp without any unscrewing. They are all made to gauge, and are thus absolutely interchangeable; so that there is no need to replace them in the particular place from which they may have been taken. When in position, the burners fit loosely at one end by resting on the injector socket, and at the other by recessing into a lug, V shape, cast on the centre gas-chamber. The ratchet attached to the bunsen tube air-shutter, which rotates on the burner, then engages a pinion on the air-adjusting spindle, which, together with the needle regulator for the gas, is operated from outside the casing. Locking nuts are provided on both gas and air regulators, so that when the adjustment has been determined, they can be fixed in position. The lower portion of the mixing chamber of the burner is coupled on by means of a bayonet joint; and this allows of getting at the gauze, for the purpose either of cleaning or renewing. The joint is provided with an asbestos washer; and that it is perfectly gas-tight has been proved by subjecting it to very high pressures. With a lamp constructed for use without inner chimneys, the reflector plate is attached by bayonet clips; and therefore only a slight movement of the hand is needed to release it. In all other respects this type is similar to the other (except that the nozzles are arranged to come closer together in the centre).

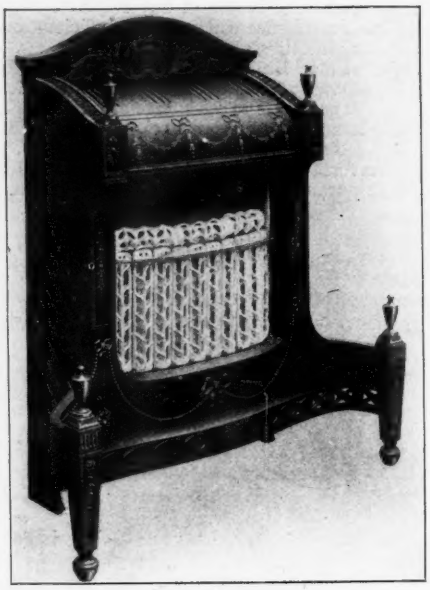
Having dealt with the lamps from the point of view of the ready accessibility of all the parts, and the ease with which any renewals can be effected without returning the lamp to the works, some notice may be taken of the bye-pass arrangements, which are also worthy of mention. The centre gas-chamber, which pre-heats the gas before passing to the burners, is divided into two parts—the top half supplying the gas to the burners, and the lower portion forming a reservoir which holds a certain amount of gas for the bye-pass supply. It is found that, having this little store of gas near the bye-pass jets, a stronger flame flashes out from the jets—with, of course, instant ignition—when the lamp is turned on. In fact, this bye-pass could not be made to fail in lighting up, during an inspection some days ago. From the reservoir, the bye-pass gas supply travels down the extension piece already referred to, until it reaches a small syphon bye-pass jet gas-box, fitted with steatite tips. This gas-box (which acts at the same time as the locking nut to keep the reflector up) collects any condensation, &c., that might otherwise interfere with the working of the jets. In case of repairs being needed to the bye-pass, a cock is provided at the side of the lever main cock at the top of the lamp, which permits of the shutting off of the gas while the work is being carried out.

No categorical claims as to efficiency are advanced by the makers; but they feel from the support which has already been accorded them that they are justified in saying the lamp is equal to others of the class on the market. Lamps of similar design, in reduced sizes, can also be had, either for glass cylinders, or without them; but with these the distance the bye-pass gas supply has to travel is so much shorter that it is not necessary to have the reservoir which is provided for the larger patterns. Then there is also on view a very pretty pattern of one-light indoor lamp, alike in construction to the others, but fitted simply with a corona, instead of a windproof outer casing. Thus there is a complete series for (say) shop lighting purposes—the biggest type for outside, the medium size for the lobby, and the interior pattern for the inside of the shop.

Before leaving the works, attention was attracted to an anti-vibrator which has a business-like appearance, and which subsequently successfully resisted some violent vibratory influences that were brought to bear upon it. To one side of the gas-supply pipe is attached the top end of a spring, the lower extremity of which is connected to the free end of the loose-fitting angle burner. To prevent the spring from losing its resiliency in consequence of the heat, it is surrounded with an asbestos covering. This anti-vibrator, in connection with the arrangement of burner referred to here, should prove useful in positions where such an appliance is desirable.

A HANDSOME "DOG" FIRE.

A few weeks ago, in reviewing Messrs. John Wright and Co.'s new programme of gas-heating apparatus for the approaching winter, we mentioned a "dog" gas-fire—the "Gelert." Messrs. Wright had at the same time in hand two other patterns of "dog" gas-fires; but these were not then in a sufficiently forward state to be photographed. We have now, however, received a photograph of one of these patterns, which is to be supplied in two



different forms—the one with, and the other without, canopy; the former being named the "Kenilworth," the latter the "Waverley." It will be seen from the illustration that the new design is a very handsome one, with ornament in the Adam style, which, it is claimed, was first applied by Messrs. Wright and Co. to gas-fires a number of years ago, in their "Stadium" pattern. The "Kenilworth" and the "Waverley" will each be supplied in 14-inch and 17-inch sizes. As regards the remaining patterns of "dog" gas-fires—the "Sirius" and the "Canem"—these will be of plain and substantial design.

It will be seen that in these new fires, as well as in the "Gelert," which has just been introduced, Messrs. Wright and Co. are applying to "dog" fires their now well-known wide-fire principle, which, judging from recent indications, would seem to bid fair to be generally adopted in the near future. The "Kenilworth" and the "Waverley," and also the "Sirius" and "Canem," will contain, like the "Gelert," all those various improvements and economical and hygienic arrangements which have created the reputation of the firm's ordinary gas-fires.

Messrs. Wright and Co. inform us that, as they desire to make a point of not formally placing any new design upon the market until they are in a position to make prompt deliveries of it from stock, they restrict themselves meantime to this preliminary announcement; and an illustrated and priced list of the "Kenilworth," "Waverley," "Sirius," and "Canem" will not be issued until the fires are ready for delivery in quantity.

FOR THE LIGHTING SEASON.

An inspection of the spacious Farringdon Road show-rooms of Messrs. Falk, Stadelmann, and Co. is sufficient to convince one of the ceaseless activity of the firm in keeping pace with—and even forestalling—the growing demands of the public in the matter of gas-lighting appliances. The collection of fittings for the inverted burner, for example, has been considerably amplified; the range of brackets (all stock lines) numbering 159 separate and distinct patterns, each one kept in two, and sometimes three, finishes. Then the pendants number 129, the majority stocked in both two and three light forms, and invariably in two finishes. The range of fittings applicable to upright incandescent lighting, too, has been much extended. In other directions, there are also provided styles and sizes of lamps, burners, and accessories well calculated to meet any requirements. A point worthy of note is that it has been sought to produce a superior class of goods, which should appeal to the eye as well as the pocket.

In regard to fittings, there is a series arranged for the angle burner, which, it is learnt, is in special demand for the Colonies of Australia and New Zealand; and, in this connection, it may be mentioned that the firm state, for the benefit of their overseas clients (and particularly those in countries offering a preferential tariff) that all their gas-fittings, both plain and ornamental, are British made. There are inverted pendants with silk shades of all kinds, as well as a comprehensive selection of the popular bead curtains and bead enrichments; and there are also stocked many different wire shapes for people who prefer to make up their own shades. For raising and lowering interior lights in churches, public halls, &c., there is a device which is easily installed and handled. This comprises a suspender of heavy vulcanized and braided steel flexible conduit, which is absorbed in a shell by means of a powerful tension spring, when a winch attached to the wall operates a cable passing up to and along the ceiling and down to the fitting. As the entire weight of the fitting is supported by

the steel cable, there is little or no wear and tear entailed on the gas-duct. It is pointed out that the action is concentric and noiseless. Owing to limitation in the capacity of the tension spring absorber, an iron or brass down-rod would probably have to be used in connection with the device in the case of very high buildings. The "Noturn" cup-and-ball joint, to obviate axial rotation, while retaining the swinging movement of the ordinary ball-joint in all directions, is of simple construction, and is being widely employed. When adopted without side lamps having advertising matter on them, it serves the useful purpose of keeping them in their original position; and on a row of street or shop lamps, it prevents the various levers from getting into different positions from the action of the wind or the turning on and off of the lanterns.

A number of new mantles to meet various requirements are being placed upon the market this season; and there are several additions in the way of inverted lamps of a cheaper and lighter pattern, but at the same time well and accurately finished. It is impossible to refer specifically to all the things that were pointed out in this department of the firm's business; but mention may be made of the "Pixie" burner, which has a narrow head, and is designed to take a specially long thin mantle. This construction is said to result in great efficiency and economy; burners of the same type being in extensive use on the Continent. The consumption is given as about 3 cubic feet per hour, for an approximate illuminating power of about 75 candles. It has already been taken up by several of the gas undertakings in the country. Another burner—and this time a very small one—which attracted attention was the "Pearl," which is intended for positions, like staircases, where only a modest light may be required. With a consumption of less than ¾ cubic foot of gas per hour, it is said to give a light of some 16-candle power. An igniting-device for attaching to an incandescent burner is so arranged that sparks emitted light the bye-pass, which in turn lights up the burner—thus saving the cost of the bye-pass flame.

With reference to outdoor lighting, mention may first be made to the "Ukay" inverted lamp, which is made throughout in England. It is arranged for suspension and for attachment to street lamp-columns. As to the suspension-lamp, it is claimed that the feature of strength in construction without sacrifice in efficiency should recommend it to lighting authorities for all maintenance purposes. The gas and air adjustment are made from the exterior of the casing; the regulators being worked by a lever movement, which is secured by rotating the shafts provided for the purpose by a small movable key, so that, once set, they cannot afterwards be tampered with by any unauthorized person. The whole range of adjustment is covered by one half-turn, through the provision of a special quick-turn thread. The primary gas inlet and individual burner feeds are trapped to prevent dust, impurities, and condensation products interfering with light development. This is the lamp's second season; and the improvements made should add still further to its popularity. It is already known beyond this country—a number having been shipped to Japan and Australia for hiring-out purposes. The lamps are made in one, two, three, and four light sizes; and there is only one continuously burning bye-pass jet, which is in a vertical position. With a gas consumption of 3½ cubic feet per burner per hour, the light developed is stated to be 110 candles per burner. The street-lamp form of the "Ukay" light is the pattern which has been supplied to the Borough of Kensington for the lighting of Earl's Court Road—there being forty of them fixed, and giving satisfaction. These lamps have been provided with outside lighting arrangement, for ignition by the Simmance-Abady flashing torch. All the internal tubes, connections, and burners, &c., are made of heavy quality cast or bar brass; while the inner chimney is made of cast iron, aluminium sprayed. Then the new high candle power models have been added to the firm's already extensive list of "Graetzin" lanterns; and they are introducing this year a cheaper make of inverted lamp for shoplighting, &c.—the "Success," indoor and outdoor patterns—to meet cases in which the question of price is all important.

THE NEW "SILVA"

High-Power Low-Pressure Gas-Lamp.

Those who desire to secure high-power lighting units without the installation of pressure-raising plants, are being successfully catered for by firms who have made it their business to look after the requirements of gas consumers in this respect. To the patterns of lamp designed for the satisfactory lighting of large areas by gas at ordinary pressures that have already been noticed in our pages, may now be added the new high-power outdoor "Silva," which is being placed upon the market by Messrs. J. & W. B. Smith, of Farringdon Road, E.C.

Much is expected by the makers of this lamp; and an inspection of it in operation, leads one to think that these anticipations are likely to be realized, for the light seems to be both absolutely steady and exceedingly brilliant. In the matter of gas-lamps, as in most others, appearance counts; and in this respect the new "Silva" is everything that can be desired. The attractiveness, so far as looks are concerned, is due to excellent make and finish, as well as to the shape of the wind and rain proof casing, which is of steel, enamelled outside in celadon green colour, and inside white, with polished metal fittings. The lamp is wholly English made; and the very greatest care has evidently been bestowed upon each detail of its manufacture. In addition to appearance, another important point has been kept well in mind all through—namely, that everything should be so substantial as to be eminently suitable for hard wear. Extra strong cast-brass burners are fitted. The glass bowl holder is provided with a hinge on one side; and by releasing the catch at the other side, the interior of the lamp is exposed. Above the burners is a white inside reflector, which (instead of being, as in the older patterns, an integral part of the cone) can be removed by undoing four screws. This a distinct advantage, as the enamel may, from one cause or another, get chipped; and should this happen, the replacement of the reflector is a matter of the utmost simplicity. Thus there is justification for another claim put forward by the makers—that every part is easily accessible for cleaning or renewal. In fact, any portion could be replaced *in situ;* and no great experience would be needed for the work.

The New "Silva" High-Power Lamp.

As to the working parts of the lamp, it will be noticed from the illustration that the gas and air adjusters can be regulated from the outside; there being separate gas adjustment for each burner. The gas passes at full pressure down to the burner, where it is adjusted by the needle-valve. In the matter of cleaning, by simply removing this needle entirely, it is possible to blow out any foreign substance that may have collected. The gas-regulator is provided with a lock-nut; and after the pressure has been adjusted, this is made use of. Then at times it may not be desired to utilize the full lighting capacity of the lamp; and should this be so, the regulator screw can be turned until the gas supply to the burner with which it is connected is completely shut off. The method of adjustment of the air-regulator, too, has been improved, so as to secure steadiness of action. The bye-passes are entirely out of sight, and out of reach of damage, above the reflector; and they are of the flash pattern—each flashing over its own particular burner.

Extra large mantles and glasses are provided; and the lamp is at present being made in two sizes—three and four burners. The illuminating power and efficiency claimed are for the three-burner pattern 750-candle power, for a consumption of 21 cubic feet of gas per hour; and for the four-burner, 1000-candle power, with a consumption of 28 cubic feet.

Masonic.

An interesting function of last week was the installation of W. Bro. John Mackay, the I.P.M. of the Northern Star Lodge, No. 5053, as Master of the Lodge Acacia, No. 2321. There was a large attendance of Yorkshire Masons at Bradford when the ceremonial was enacted; and everything passed off in most satisfactory style. A considerable gathering of members of the craft—a number from the Northern Star and Evening Star Lodges—assembled to do honour to their popular member. Among others present were Bros. J. H. Brearley, J. W. Broadhead, Thomas Cash, J. S. Dougall, Matt. Dunn, W. D. Helps, T. W. Jordan, F. H. Lamb, J. M'Ewen, J. Naylor, G. H. Niven, John Niven, W. H. Nutter, R. Scott, R. G. Shadbolt, J. Taylor, E. O. Watson, E. J. Wellens, J. H. Wilkinson, J. E. Williams, and Charles Wood. ——The list of appointments this year to "London Rank" includes the name of W. Bro. Reginald W. Foster—a member of the Evening Star Lodge, and a P.M. (also D.C. at the present time) of the New Cross Lodge No. 1559, the brethren of which are presenting Bro. Foster with the Clothing of the Degree.

During the past three months, the Road Board, with the approval of the Treasury, have made advances amounting to £131,764 from the Road Improvement Fund to county councils and other highway authorities. This sum includes £111,555 for the improvement of road crusts, including grants towards tar, macadam, &c., and surface tarring. The total grants made by the Board for these purposes up to Sept. 30 last amounted to £321,445.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Malton.

After an interval of twenty-five years, the members of the North of England Gas Managers' Association visited Malton last Saturday on the occasion of the sixty-ninth half-yearly meeting. The gathering took place in the Assembly Rooms, and, appropriately enough, it was presided over by Mr. HENRY TOBEY, who was President of the Association on its former visit to the town. There was a good attendance of members.

The PRESIDENT, at the outset, explained the absence of Alderman Metcalfe, one of the Directors of the Malton Gas Company, and a member of the North Riding County Council, who was to have welcomed the members. He said he was engaged on his magisterial duties, and would attend the meeting at a later stage.

ALDERMAN METCALFE'S WELCOME.

Subsequently, Alderman Metcalfe entered the room, and was introduced by the President.

In addressing the members, Alderman METCALFE expressed his regret at the absence of the Chairman of the Gas Company, Mr. Hugh W. Pearson, whose business prevented his attendance. On behalf of himself and his fellow-townsmen, he welcomed the members to Malton. They were always, he said, pleased to see any Association, of whatever kind, visit their town, because they felt that they would go away considerably impressed with the advantages that were offered in a small community like their own. With regard to the Malton Gas-Works, he might say they were established in 1834 by a man named Jonathan Malam. He was anxious to get rid of the undertaking, probably at a considerable profit; and in 1836 he disposed of the gas-works to a Company, of which his (the speaker's) father was one of the original Directors. At the time of the institution of the works, the price of gas was 13s. 4d. per 1000 cubic feet. [Laughter.] They had now brought it down to 2s. 6d.; and, considering the distance they were from a coalfield, they could compare favourably with almost any other town, and more favourably than with some of the same size as Malton. At Whitby, the price was 3s. 7d., at Filey 3s. 6d., and at Driffield 3s. 4d.; so they considered they had held the balance very fairly between the shareholders and the general public. They had been fortunate in having a very good Manager; and a good deal of the credit for their success must fall upon him. They had been unable to do everything that had been asked of them by the town. However, they had not only studied its interests, but had also done their very best, on several occasions, to avoid friction between themselves, the governing authority, and the general consumers, which he believed was not the case in many towns at that time. Their shares were held principally by local people, many of them widows and spinsters. But a few years ago the Northern Counties Electricity Supply Company made an inroad into Malton, and, by some arrangement with the local authority, became established there. One of the terms on which they came was that they guaranteed to charge for lighting purposes "30 per cent. less than the gas company were doing." Whether or not this arrangement had been fully carried out, he very much doubted. The price of gas had been reduced since then; and he could safely say that they, on the other hand, had not reduced the price of electricity. So that it came 30 per cent. lower than Malton supplied them with gas.

The PRESIDENT: And lower candle power, too. [Laughter.]

Alderman METCALFE (continuing) said they were lighting one part of the old borough of Malton which was separated from them (Norton) by gas; and there they had a most brilliantly-lighted town; whereas Malton was lit by the electric light, which he could only describe as a kind of "dim religious light." [Laughter.] It was not an uncommon occurrence for four or five lamps to be out at once; and it was a rare thing indeed for the whole of them to be lit on any one night. He thought, therefore, the Malton people must now see what a mistake they had made in substituting electricity for gas. When the Company were asked to tender for the lighting of the town that year, the specifications were made out entirely for electricity. This did not apply to gas at all. When electricity was substituted for gas, the Company had to take away the connections between the standards and the mains; and the standards themselves had to be scrapped at considerable loss. This was done out of revenue in something like four half years. He would give the members an idea of the cost of gas and electricity. At Norton, which was in the East Riding, the three years' contract for supplying the power for pumping the water ran out, and application was made both to the Electricty Company and to the Gas Company for tenders for carrying out the work for one year or five years optional. The tender of the Electricity Company, whose previous contract was £100, was £178, and the contract of the Malton Gas Company was £96; so practically the Electricity Company were desirous of charging the Norton Urban District Council twice the amount for which the Gas Company were prepared to do the work. He need hardly say that, after discussion by the Council, the tender was given to the Gas Company; and they would no doubt, even at their price, be able to show a small profit on the transaction. Near their works, during some excavations, they found the remains of an old Roman camp; and he believed at the present time there was a fine bowl of Roman pottery at the York Museum. This might be of interest to those who cared about these matters. In conclusion, he trusted the members would enjoy the short time they would spend in Malton, and go away very favourably impressed with their little town. Their geographical position was a good one. Malton was the border town of the North and East Riding towns of Yorkshire. It was a large agricultural centre, and the business done was considerable. The population was less than 10,000—Malton, Norton, and Old Malton combined. He gave the Association a hearty welcome to their old town, and expressed the hope that it would not be the last occasion the members would pay a visit to it.

A NEW ASSOCIATE.

There was only one candidate for associateship—Mr. A. E. Rufthead, of the Corporation Gas-Works, Darlington; and, on the motion of Mr. F. P. TARRATT (Darlington), seconded by Mr. C. DRU DRURY (Sunderland), he was unanimously elected.

THE LATE SIR SAMUEL SADLER.

Mr. W. FORD (Stockton-on-Tees) moved a vote of condolence with the widow and family of the late Sir Samuel Sadler. He said he could not express the loss the Association had sustained through the death of their esteemed Past-President. Most of the members present—without going back to ancient times—would remember the kindness shown by Sir Samuel in presiding at their meeting at Stockton on the occasion of his (the speaker's) occupancy of the presidential chair of the Association. They must remember his genial face, his kindly words, and his sympathy with everyone with whom he came in contact during his life. He (Mr. Ford) had known the deceased for more than forty years; and he had yet to regret his acquaintance with him in any single case, not only as a friend but as a business man. He thought he was a most excellent man, and one whose word, so far as his (the speaker's) experience went, was his bond. He never knew Sir Samuel shirk a contract, or grumble when one resulted in a loss; and those who had business connections with him would regret his removal. He (Mr. Ford) had intimate knowledge of Lady Sadler during her married life, and even before; and a more genial lady could not be found in the county of Durham. With these few words he would simply move that a vote of condolence be passed and conveyed to Lady Sadler and her sons on the great loss they had sustained in the death of her husband and their father.

The PRESIDENT added that they would all miss the kindly face of Sir Samuel Sadler, who was a very genial man.

The vote of condolence was carried by the members silently rising.

The PRESIDENT then delivered the following

PRESIDENTIAL ADDRESS.

Gentlemen,—Let me assure you I feel very strongly that you have done me a great honour in again (after an interval of a quarter of a century) electing me your President. Naturally, in this period of time, very many changes have taken place, and many faces which were formerly seen at our gatherings have vanished.

GAS SUPPLIERS AND THE PUBLIC—NEW METHODS.

Looking back over the twenty-five years which have passed since I occupied the chair, I might be tempted to indulge in reminiscences; but I forbear. I may, however, be allowed to note the striking change which has occurred in the attitude of the gas suppliers to the public. It used to be a very independent attitude. Now it is a solicitous attitude on the part of gas suppliers. No doubt, competition is answerable in a large degree for the change. Electricity was threatening to extinguish the gas industry, and forced it to bestir itself in an endeavour to prolong its existence. But there were other factors tending to cause a change. Formerly gas had little to offer to the public except light—its almost only use was for illumination. But, in the course of time, appliances for the use of gas for other purposes than lighting were introduced, and offered to the consumers for their use. The gradual improvement and development of these appliances has helped most materially to carry the gas industry along the road of expanding consumption. It has been of mutual advantage to the gas suppliers and the gas users that appliances for utilizing gas have, in the last quarter of a century, been continually advancing in efficiency and have been adopted by the public; so that now it is a question whether more gas is used for cooking, heating, and industrial purposes than for illumination. Gas suppliers have not been slow to appreciate the efforts of the manufacturers to produce efficient appliances such as would take the taste of the public and would be of advantage in obtaining new customers.

EARLY DAYS OF THE WELSBACH BURNER.

I may perhaps be allowed to recall the fact that the discovery by Dr. Auer von Welsbach of the incandescent light was announced to the public in this country in the year 1886—the year in which I previously occupied the chair. A paper was read upon it at the Birmingham meeting of the British Association that year. It does not appear to have been on view in London until February, 1887,

when it was shown at the Marlborough Rooms. Speaking of the Welsbach burner in 1886, the "JOURNAL OF GAS LIGHTING" said that this latest of the many incandescent gas-burners that had been tried and found wanting was apparently not destined to prove a stronger foe to electric lighting than any other description of gas-burner. How far wide of the mark this opinion has proved to be, it is not necessary for me to point out. The first occasion on which the light was displayed before the gas profession was at the Gas Institute meeting held at Glasgow in 1887. If I remember rightly, several of the new incandescent burners were shown in operation on one of the landings at the *conversazione* held at the Corporation Galleries at the close of the meeting. But the light at that time was so little before either the gas profession or the public that, although it was a new method of obtaining light, no mention was made of it in the Presidential Address delivered by Mr. Foulis. He referred to the subject of obtaining light by incandescence, pointing out that all artificial light is obtained by the incandescence of solid material; and he went on to state the volume of light which was procurable by raising platinum to various temperatures—the light ranging from 1 candle at a low heat to 587 candles when the melting point was reached. It is somewhat remarkable that, during the meeting of the Institution held this year in Glasgow, no reference was made by any speaker to the advent of the incandescent burner on the occasion of the previous meeting in Glasgow.

The development of the incandescent light has been of incalculable value to gas undertakings, by enabling them to hold their own in competition with the electric light. We can only conjecture what would have been the position of coal-gas undertakings but for this timely discovery. When we consider the quantity of illumination which formerly could be obtained by even the best burners from the combustion of 5 cubic feet of gas, and that which is obtained now, it is matter of astonishment. Finality in the volume of light which can be got has apparently not yet been reached. We read of 42 candles per cubic foot per hour with low-pressure gas as having been reached. Though the light has done us such splendid service, its very merit of yielding so large a quantity of light, with the consumption of so small a quantity of gas, has operated to curtail our sales considerably. However, we could not have it both ways, and are well content it should be as it is.

Another result from the use of the incandescent light is that it requires more pressure to make it efficient than was necessary for flat-flame lighting. Low pressure was no detriment to the latter form of lighting, so long as it was sufficient to fill the burners. In the immediate neighbourhood of the town there was no difficulty in increasing the pressure for incandescents; but to mansions lying on the outskirts, it was not so easy of accomplishment, and the size of the mains has had to be enlarged to transmit sufficient pressure if the customers were to be satisfied and their lights efficient. At the same time, there would probably be a decrease in revenue from the less gas consumed by the incandescents compared with the flat-flames.

COMPETITION OF ELECTRICITY IN MALTON.

While most manufacturing towns and pleasure resorts increase rapidly in size and population, many agricultural towns are either stationary in both respects or they are diminishing. There are none of those leaps and bounds in gas consumption which may be read of as taking place elsewhere. When under such conditions a competitor enters one of these stagnant towns to divide the business, a tough struggle is at hand. When the Electric Supply Company first started in Malton (which it did in 1903), it necessarily followed that, if they were to do any business at all, the Gas Company must suffer. It tried to keep its customers by lowering its price from 2s. 10d. to 2s. 6d. per 1000 cubic feet—a price which, considering the size and position of the town, is admittedly low. The loss of the public lighting and some of its consumers who went over to the Electric Company for light and power, combined with the reduction in price, had a serious effect upon the Company's finances. It is true the consumption was kept up by developing the penny-in-the-slot system of supply; but, as you are aware, this class of business entails the employment of considerable capital and a large amount of labour in proportion to the revenue derived from it. The result of having the Electricity Company in competition is that, though we are selling about the same quantity of gas as we did six years ago, we are doing it with a less margin of profit. The character of the business has considerably changed. It is in the loss of the larger consumers that we get hit. If a consumer of (say) 150,000 cubic feet a year leaves us, we want some ten penny-in-the-slot consumers in his place to make up the loss.

ASSESSMENT TROUBLES IN THE TOWN.

It was from the operation of these causes that the Gas Company sought to have their assessment for rating purposes reduced. It was not diminished gas consumption, nor increased cost of coal, that the Company put forward as the ground of their application. It was the altered incidence in the consumption, and the large increase in tenant's chattels. The landlord's property had remained much the same; but the tenant's property had very considerably increased. The relative proportions had altered. The change from one consumer to fifteen consumers entailed much extra work in the distributing and clerical departments; and the tenant had to keep a larger staff of clerks and fitters than formerly, to do practically the same volume of business. The Assessment Committee, not understanding the bearings of the matter themselves, called in an expert valuer, who advised them to put up the valuation instead of reducing it. They adopted his advice; and this was the fatal step they took. It left the Company no option but to appeal to Quarter Sessions, which they did, and secured a reduction below the moderate amount they originally asked for. The costs were very serious—amounting to over £1000—the bulk of which fell upon the Poor Law Union.

REFLECTIONS ON ASSESSMENT "PRINCIPLES."

To my mind, the system of assessing such undertakings as gas-works needs revision. The adoption of a hypothetical tenant in these cases should, under modern conditions of gas supply, be supplanted by some other system. In those gas-works which belong to the progressive class, and cater for the public by providing for its use all sorts of gas appliances either on hire or free, the allowance which has been made in the past, and usually applied, would in some cases absorb nearly the whole of the profit of the business, and leave little or nothing for the landlord's rent. This would be reducing the valuation to an absurdity. That undertakings of public utility should be assessed by calculating their rateable value from their profits, and taking this as a starting point, and not treating other manufacturing concerns in the same way, savours of injustice. Why not assess breweries, flour mills, ironworks, engineering shops, &c., on the same basis as gas-works? To make profits the basis of the assessment is in direct contravention of the law which explicitly says that profits shall not be assessed. Then why should they be brought into the calculation? The rent of the hereditament is what the assessment should be based upon—not the profits in trade derived from the use and occupation of the place. The roundabout method of setting up a hypothetical tenant should be superseded by some more direct one. The hypothetical tenant has lived long enough, and brought complication and confusion into the business. We have been told that it has baffled the keenest minds to devise or suggest a method of assessment better, and which would bear equally and fairly on all undertakings; but I think we may challenge the statement, and say that it would be a task to the ingenious to devise a system that would be more involved, and give more diverse results, than the hypothetical tenant does.

Many considerable businesses are carried on in small premises, with large profits accruing therefrom; but the landlord does not derive a large rent, nor the assessment committee a large rate, from the premises in consequence thereof. Let us have a hypothetical landlord. Eventually the structural value has to be taken into account; and it seems to me it would be as well to start with this, as with the tenant's profits. When a capitalist invests money in buildings and plant, he expects to get something like the current rate of interest upon it in the shape of rent. By comparison with other premises in the neighbourhood, and the yield they give on the outlay made upon them, it should be possible to arrive at a fair sum for the rent of a gas-works.

ADVANTAGES OF STATUTORY POWERS.

The question sometimes presents itself: Is it to the advantage of small gas companies to obtain statutory powers? The only thing they gain which they have not already, is the authority of Parliament to open the streets. In every other respect, statutory powers impose limitations and obligations which are of no value to them. The area of their works; the area within which they can supply gas; the amount of capital they may raise; the dividends they may pay; the price they may charge for gas, and its illuminating power—are all taken from their control. They sacrifice all their liberty in these respects so as to gain the sole right to break open the streets and incidentally thereby to gain a monopoly of the supply of gas in their neighbourhood. To small concerns the cost of an Act or a Provisional Order means a very considerable outlay; and it may justly be thought by them not to be worth the money. They are probably going on very well as they are, and supplying gas on terms which are fair and moderate. And as long as they, as purveyors of an article of public utility, do so in a reasonable and just manner, it is not at all probable that they will be opposed and other works be started in opposition. An Act of Parliament would not enable them to supply either cheaper or better gas, but rather, by its expense, add to its cost. It may be urged that an Act gives a company security of tenure. There is, of course, considerable weight in this; but a company which is acting fairly and squarely, and is not rapacious in its dealings, has little fear of being disturbed. An extortionate company deserves to meet with reprobation and opposition, and has itself to blame if trouble arises.

Gas companies want to be of native growth, and not be exploited by aliens to the district whose only object is to draw as much revenue as can be extracted from the community.

That statutory powers may have a cramping effect upon a company I know. There are gas companies whose concerns I am aware of, working under statutory powers, who have about come to the end of their capital, and have filled up the area of land scheduled for their works. They are companies supplying small agricultural towns; and in the course of a number of years they have grown very slowly to their present output of gas. They are now hide-bound by their parliamentary powers. They might continue to grow in the same leisurely way had they more capital and more land; but they hold back from seeking them on account of the expense which a Provisional Order would be to them. It is more prudent and advantageous on their part to check the consumption of gas than to expend what to them is a considerable sum on a Provisional Order. The expense would be a very heavy

burden, and reduce the moderate dividends at present paid. The growth of consumption would be a long time before it caught up with the outlay. Therefore they prefer to go on as they are.

The cost of an Order is not proportioned to the size of the company, but is practically the same whether it is selling 5 millions or 50 millions. The legislative authority in the instances mentioned has a repressive effect; and, instead of promoting the interests of the community, it is detrimental to them. I doubt whether their statutory powers have ever done those companies any good. A dictum has recently been given by the Chairman of the Parliamentary Committee of Ways and Means that gas undertakings should periodically come under parliamentary review. He said with regard to the gas undertakings of local authorities that the Committee did not wish to compel them to come to Parliament every three or four years, neither did they wish to encourage a system which enables a local authority to keep away from Parliament for a long period. The Committee have no doubt the same views with regard to gas companies as they have regarding municipal undertakings. There are a number of companies whose incorporation dates back many years; and they are carrying on their businesses under hoary-headed Statutes.

The Malton Gas Company were in Parliament so far back as the year 1880. They were given such liberal powers with regard to raising capital that, though thirty years have elapsed, they have so far only expended their "original capital." It seems probable they may go on for half-a-century longer without again facing a Parliamentary Committee. Certainly in the past the consumers have not suffered in any way because the Company have not been to Parliament again. Neither, as far as I can learn, do the consumers supplied by those ancient companies I have referred to appear to have been badly dealt with, nor to be any worse off than consumers under companies whose statutory powers have received recent revision.

Statutory powers are certainly of some assistance when having to deal with such autocratic bodies as railway companies. My experience has been that, when occasion has arisen to cross their lines with gas or water mains, either on the level or over their bridges, they very promptly demand payment for an easement, and require a one-sided agreement (drawn up by themselves) to be entered into and paid for. The demand has, however, been invariably met by a refusal. I suppose they succeed in some cases in getting their demands complied with; but if the gas or water undertaking has statutory powers, there is no compulsion to do so. The railway company have acquired by Act of Parliament power to lay down their railway, and in doing so they curtail the full and free user of the surface of the road formerly enjoyed by the public. The gas undertakers have parliamentary power to lay down their mains, and in doing so to break open the streets. Both undertakers are there by statutory authority; and the power of the one is equal to that of the other as regards the use of public streets or roads. It is true the railway company, in purchasing the land on either side of the street, have also become possessed of the soil lying between the two sides, subject to the right of the public to pass over it. They have just the same right to the subsoil of the street that they cross as any other owner of property on the side of the street has and no more. But it does not give them the right to charge a wayleave for the pipes of a statutory undertaking passing through any portion of the soil. If the railway company are entitled to charge, then all the owners of property abutting on the street are also entitled to do so, as they own the soil half way across the street.

VALUE OF A CARBURETTED WATER-GAS PLANT.

Some ten years ago, the Malton Gas Company put down a carburetted water-gas plant, which has proved very serviceable. It enables them to work the retorts to better advantage than formerly. They can now be kept fully at work all the time they are under fire. When the daily consumption is increasing, and the retorts cannot keep up to the demand, the water-gas plant supplies the deficiency; and this goes on till the consumption has reached such a point as will keep another setting of retorts at work. The reverse of this method is adopted when consumption is waning—bed by bed being dropped, as soon as they cannot be kept fully charged; and the water-gas plant is then used to keep up the gasholders. Another considerable advantage of a water-gas plant is the control it gives of the coke market. The price obtained for coke is now much better than formerly, when, for the sake of elbow room, it had to be disposed of. Forced sales only realize low prices. It is a decided advantage to possess such a plant, even though the prime cost of making gas by it is somewhat higher than that of coal gas.

TELEGRAM FROM MR. SHADBOLT.

At this point, the HON. SECRETARY (Mr. Herbert Lees, of Hexham) read the following telegram which had been received by the President: "Much regret inability to join you to-day. Please accept best wishes for success of meeting.—Shadbolt." Mr. Lees mentioned that letters apologizing for absence had been received from several members of the Association.

HIGH AND LOW PRESSURE DISTRIBUTION SCHEMES AT TYNEMOUTH.

The paper on the above subject read by Mr. F. C. WILLIS, of North Shields, before the Association at the spring meeting, and given in the "JOURNAL" for the 9th of May (p. 375), as also a supplementary one appearing elsewhere to-day, p. 112, were then discussed.

VOTES OF THANKS.

Mr. W. FORD proposed a vote of thanks to the President for his very able address. Mr. Tobey had, he said, been a member of the Association since its commencement, and during the whole of the time had done valuable work for it. He had that morning given the members a very valuable addition to the "Transactions" of the Association. The address was eminently to the point. The President touched upon matters such as incandescent lighting which he (the speaker) thought, even at that moment, was more interesting than it had been before. They found the incandescent mantle was being so improved that he believed there was a future in store for gas lighting such as they had not had in the past. He thought other matters in the address were of particular interest. Without going into details, he might say the President had put these matters into the "Transactions" of the Association, and they would afterwards be found very useful to many of the members.

Mr. C. DRU DRURY (Sunderland), in seconding the motion, was sure the remarks just made would meet with the approval of all present. He thought it was an excellent idea of the Committee to invite Past-Presidents to take the chair. The occupancy of the chair by their worthy President on the previous occasion now coincided exactly with the rise and progress and the splendid results obtained with incandescent lighting. In his opinion, the Association must benefit enormously by the ripe experience gained in such periods between the occupancy of the chair such as Mr. Tobey had had. He felt sure it was the hope of all of them that their genial President would live for another period of twenty-five years to occupy the chair for a third time, and that the results achieved by gas lighting would show as great progress as had been made in the last quarter of a century.

The motion having been cordially passed,

The PRESIDENT thanked the members for their kind expression, and remarked that he did not think he should see another twenty-five years. He considered their thanks were due to Mr. Willis for his valuable paper read at Newcastle, and also for his supplementary paper submitted that day.

The vote of thanks was accorded; and Mr. WILLIS having acknowledged it, the meeting terminated.

THE DINNER.

The members then dispersed for dinner. Owing to the limited accommodation at the hotels, they divided—some dining at the Talbot Hotel and the others at the Green Man Hotel. The President, accompanied by Alderman R. Metcalfe, occupied the chair at the Talbot Hotel.

Mr. GALLOWAY (Whitby) proposed "Success to the Malton Gas Company, coupled with the name of Mr. Tobey." In so doing, he congratulated the Malton Gas Company on their successful rating appeal, to which reference has already been made in the "JOURNAL." They at Whitby were fortunate enough not to have to go to Quarter Sessions; and, happily for the Company, they were able to get a reduction of about 40 per cent. on the previous rateable value. He congratulated the Malton Gas Company upon the position they held with regard to the price at which they supplied gas.

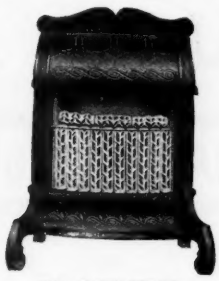
Alderman METCALFE, in responding to the toast, said the Malton Gas Company was a successful business concern. It was well managed, and those connected with it had no reason to complain of the support they received from the town and the immediate district. They paid 12 per cent. dividend, and had done so for the last fifteen or sixteen years—ever since they obtained an Act of Parliament, by which the initial price was fixed at 4s. per 1000 cubic feet. By correspondingly reducing the price, they were now entitled to pay 14 per cent. In conclusion, he gave a short history of the town; dwelling on its agricultural and other interests.

At the close of the repast, the members were conveyed by brakes to Castle Howard, where, by permission of the Countess of Carlisle, they viewed the Castle—admiring its numerous beauties, as well as those of the surrounding country. The return journey was safely accomplished after a very enjoyable day.

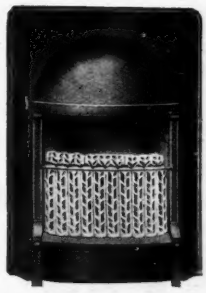
At the meeting of the Newcastle-upon-Tyne City Council last Wednesday, Sir William H. Stephenson, the Chairman of the Newcastle-upon-Tyne and Gateshead Gas Company, was again selected as Lord Mayor, for the third year in succession. There was no other nomination.

We are asked by Dr. W. A. Bone, F.R.S., Livesey Professor at Leeds University, to state that, having accepted an invitation to give an experimental lecture on "Surface Combustion" before the American Gas Institute at their annual meeting at St. Louis on the 18th inst., he will be away from England until the 1st of November. In his absence, Mr. H. H. Gray, B.Sc., will have charge of his department at the University; and all communications may be addressed to him. Dr. Bone expects to commence his winter course of lectures on "Gaseous Fuel and Combustion" at the Imperial College of Science and Technology, South Kensington, on Friday, the 3rd prox., at three o'clock. There will be twenty lectures, in two parts. In the first, Dr. Bone will review the principal researches upon gaseous combustion from the time of Davy until 1880; and in the second, he will deal with the present state of our knowledge on the subject. The inclusive fee for the course is £2. Dr. Bone says he will be glad to welcome as a hearer anyone connected with the gas industry.

The "MASCOT."



The "GELERT."



The "TALISMAN."

WRIGHT'S

"INTERCHANGEABLES"

MINIMUM MAINTENANCE!

The "THERMO X" Series

for 1911-12 consists of

FORTY-FOUR

GAS FIRES of different sizes and patterns. All these are genuine distinct stoves made in cast-iron, and every one suitable for Hiring out by Gas Undertakings . . . . . .

YET ALL ARE MADE UP

FROM

ONE SET OF PARTS

in each size—

excepting certain parts of the "N.V."—

only the front castings are different.

THEY CAN BE HAD IN MANY DISTINCT STYLES OF FINISH.

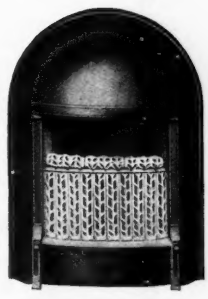
JOHN WRIGHT & Co.,

The Pioneers of Interchangeability and Standardization in the Gas-Stove Industry,

Essex Works, Birmingham.

No. 278.

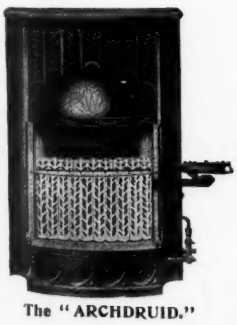
The "WIZARD."



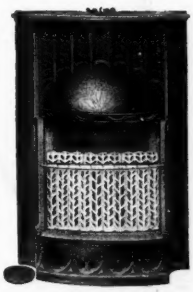
The "MERLIN."

The "WARLOCK."

The "FORUM."



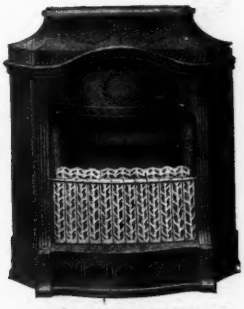
The "ARCHDRUID."



The "DRUID."

The "SALON."

The Patent "N.V."



The "STADIUM."

THE MUTUAL INTERESTS

OF THE

GAS ENGINEER — MANUFACTURER — AND CONSUMER

are

so **LINKED** together

that any **FAILURE** on the part of

THE MANUFACTURER

may prove disastrous to both

GAS ENGINEER and **CONSUMER**

We have

DOUBLY STRENGTHENED this **CONNECTING LINK**

by the introduction of our

New P.S.C. Models

which are rapidly gaining

THE HIGHEST APPRECIATION

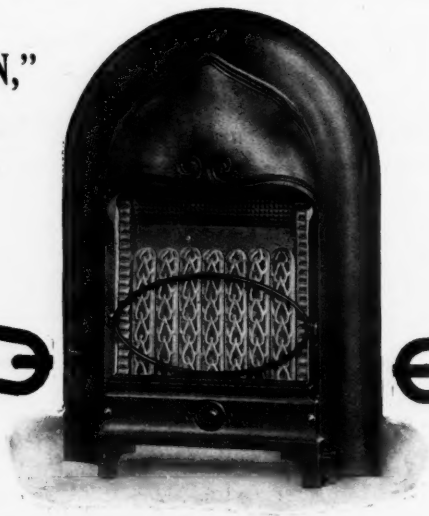
of the

Gas Engineer and Consumer alike.

May we **STILL FURTHER STRENGTHEN** our **CONNECTION** with you **BY SENDING SAMPLES?**

The "SPARTAN,"
one of the
P.S.C. Series.

Price 21s.



The PARKINSON STOVE CO., LTD.

BIRMINGHAM and LONDON.

HIGH-PRESSURE GAS DISTRIBUTION.

By E. W. Smith, M.Sc.

[A Lecture delivered at the Manchester University, Oct. 7.]

I intend during the short time I have at my disposal to deal in more or less detail with two important aspects in the distribution of gas at high pressure. It is not my intention to endeavour to convert you to a belief in the advantages to be gained by the transmission and distribution of gas at high pressure—that is, at pressures higher than (say) 60 inches of water. I suspect I should be exhorting the already converted.

Of the many problems that present themselves, I wish to confine myself to a discussion of the results of experiments on the compression of gas, and of the various determinations that have been made in connection with the flow of gases through pipes at high pressures. With few notable exceptions, one has to look to America and the Continent for accounts of systematic work in these directions; and although the conditions under which they are often carried out differ largely from the conditions existent in this country, the results are none the less of much value to us. If in the course of my lecture I appear to treat my subject rather simply, it is because I desire to take for granted as little as possible, and develop my argument from recognized premises.

The first systematic observations on the influence of pressure on the volume of a gas are those of Boyle. In 1662, he announced an important law which bears his name. He stated that the volume of a gas varied inversely with the absolute pressure. In other words, the product of the pressure and volume is a constant. This law is usually expressed by the equation

$$pv = c$$

where c is a constant. Marriotte announced the same law a few years later. The effect of pressure on the volume of gases has been studied by a large number of investigators with a view to the liquefaction of gases; and it is mainly from the results of their researches that we owe present-day knowledge.

Boerhaave (1731), in the English edition of his "Elements of Chemistry," remarked that the first property, then, of air which offers itself to our consideration is its fluidity, which he concluded was permanent. Another law which he stated held true related to the permanence of the elasticity of the air. He came to the conclusion that air is neither capable of being solidified by the intensest cold nor the greatest degree of compression. Dalton, however [Dewar, Proc. Royal Society 8, p. 657, 1878], stated as his opinion that all gases were capable of being liquefied by means of low temperature and high pressures. Boerhaave showed that "Air . . . is always expanded in the same measure by the same degree of fire, so that . . . these expansions by a constant law of Nature are always proportional to the augmentations of heat."

As early as 1702, Amontous [Haüy Nat. Philos. Eng. Ed., pp. 255-260] showed that the temperature of a gas is increased in proportion to the amount of compression it undergoes. We now know from the work of Guy Lussac (1802), as well as from that of Dalton and Charles, that an increase of 1° C. in temperature increases the volume of a gas by about 1/273 of the volume at 0° C., provided the pressure remains constant. Since Boyle propounded his pressure-volume law, many observations have been made to test its validity. Van Marum, in 1799, called attention to the fact that ammonia gas did not obey this law.

Despretz [Ann. de Chim. et de Phys. (2) 34, p. 335] determined the relative compressibilities of a number of gases. He found that at the higher pressures some gases were more compressible than others. Similar observations were made by Pouillet. In 1830, Arago and Dulong [*Ibid.* (2) 43, p. 74] experimented with air at pressures ranging from 15 lbs. to 400 lbs. to the square inch, and found that the observed volume was usually less than the calculated volume from Boyle's law. Matterer, in 1854, studied the effects of pressures up to 3000 atmospheres on oxygen, nitrogen, air, and hydrogen. The following table contains some of his results. These measurements can only be approximations; but they are accurate enough to indicate that it is only at comparatively high pressures that these gases deviate to an extent sufficient to appreciably affect our methods of dealing with gases compressed to (say) one or two atmospheres pressure for distribution and transmission purposes.

Table I.—*Exceptions to Boyle's Law.*

[Matterer, 1854.]

Hydrogen.		Oxygen.		Nitrogen.	
Volume.	Pressure.	Volume.	Pressure.	Volume.	Pressure.
8	8	7	7	5	5
18	18	17	17	15	15
28	28	27	27	25	25
38	38	37	37	35	35
48	48	47	47	45	45
58	58	57	57	55	55
68	68	67	67	65	65
78	**78**	77	77	75	75
88	89	87	87	**85**	**85**
98	100	97	97	95	96
198	222	117	117	195	206
298	352	147	147	295	336
398	505	**177**	**177**	395	542
598	930	187	188	495	882
798	1584	207	210	595	1546
928	2154	507	670	705	2790
1008	2790	657	1354	..	..

Regnault investigated the subject more thoroughly. He showed that the product of pressure and volume does not remain constant, but varies considerably at high pressures. In every case except hydrogen the compressibility was found to be greater than that calculated from Boyle's law. With hydrogen, the compressibility was found to be less than the calculated value. This caused Regnault to distinguish hydrogen as a *gas plus que parfait*. For all practical purposes, however, the whole of the constituents of coal gas, with the exception of some of those classed for convenience under the head of the C_nH_{2n} compounds, at pressures between atmospheric and three atmospheres, behave like a perfect gas.

This can be seen from the experiment on the table before me. Each increment of pressure brings about the same amount of contraction whichever gas is compressed, and on releasing the pressures the gases return to their original volumes. Even ethylene, usually the chief constituent of the C_nH_{2n} series, behaves in this way at normal temperatures. These constituents may consequently be considered, for even accurate work, to be perfect gases and obey Boyle's law at the temperatures and pressures likely to be employed in any large-scale transmission of gas in this country. This bears direct relation to the question of the liquefaction of gases, for while investigators were finding exceptions to Boyle's law, Andrews was considering the problem of the liquefaction of gases. Maxwell, in his "Theory of Heat" (p. 124), says: "The experiments of Andrews on carbonic acid furnish the most complete view hitherto given of the relation between the gaseous and liquid states of matter, and of the mode in which the properties of a gas imperceptibly changed into those of a liquid."

The question of the relative value of temperature and pressure had long been discussed; and the observations of Caignard de la Tour, Drion, and Mendeljeffe all pointed towards the conclusion that for every gas there was a certain definite temperature above which it was impossible to liquefy it, whatever pressure was exerted on it. These results were, however, unheeded until Andrews published his brilliant researches in this field. This definite temperature above which it is impossible to liquefy the gas (called, by Faraday, the "*Caignard de la Tour Point*") Andrews called the "critical temperature." The pressure which is necessary to liquefy the gas at the critical temperature is usually known as the critical pressure for that gas. The lower the temperature, however, once the critical temperature has been reached, the lower will be the pressure that is necessary to liquefy the gas. For instance, methane, with a critical temperature of −81·8° C., and a critical pressure of 55 atmospheres, will liquefy at atmospheric pressure at the temperature of liquid air − 191·4° C. These points (the critical temperatures and the critical pressures) are known as the critical constants of a gas. A list of those relating to most of the constituents of coal gas is given in Table Ia, with the names of the investigators who are responsible for each determination.

Table Ia.—*Critical Constants.*

Substance.	Critical		Boiling Point.	Freezing Point.	Observer.
	Temperature.	Pressure.			
Acetylene . . .	+ 37·5°	68	..	..	Ansdell
Air.	—	—	—	—	
Carbon dioxide . .	+ 31°	75	− 78°	− 65°	Andrews
Carbon monoxide .	−141°	36	−190°	−207°	Wroblewski
Ethylene	+ 10·1°	51	−102·5°	−169°	Dewar
Hydrogen . . .	−234·5°	20	−252°	..	Dewar
Methane	− 95·5°	50	−164°	..	Dewar
Nitrogen	−146°	35	−194·5°	−214°	Olszewski
Oxygen	−118°	50	−183°	..	Wroblewski
Water.	+358·1°	..	+100°	0°	Nadejdine

It will be seen that a low temperature is the chief essential—a temperature which is never likely to be obtained in any distribution system in this country, even if the requisite pressure were present in the mains; and this is not likely to be the case. The figures in the tables we have just been considering relate to the critical constants of gases unmixed with other gases. When mixed with other gases, Andrews found that the critical temperature of such gases as carbonic acid was lowered. Dewar and others have confirmed this. Quite recently, Dr. Kuenen has done a large amount of work in this connection.

From the results of all known investigations, it may be concluded that the simple effect of compression below 20 atmospheres at the lowest temperatures ever likely to be obtained in our mains is insufficient to liquefy any of the constituents of coal gas already mentioned. Should any of these constituents be found in the condensed liquors obtained from the mains, their presence will be due partly, if not entirely, to their solubility, more especially at high pressures, in the water and the heavy hydrocarbons which have been condensed owing to a decreased temperature and increased pressure.

Now, so far, I have left quite untouched the question of the liquefaction or, as we usually term it, the condensation of benzene, naphthalene, and water vapour. These are all known as vapours

when they are present with the gas in the mains. The distinction between a gas and a vapour drawn by Andrews has met with general approval. It is based on the critical temperature. Many of the properties of a vapour, he said, depend on the gas and the liquid being present together. This is only possible at temperatures below the critical point. A vapour can then be defined as a gas below its critical temperature. Vapours can be condensed to liquids by pressure alone, while a gas cannot.

At this point, it will prove useful to consider some of the properties generally attributable to vapours. All liquids have a tendency to become vapours; and the measure of this tendency is known as the vapour tension of the liquid. Each liquid has at each temperature a certain vapour pressure at which there is equilibrium between the vapour and the liquid. The vapour pressure of all liquids increases with rise in temperature. When the vapour tension just exceeds the external pressure, the liquid boils, while pressure brings about condensation when the external pressure on the vapour just exceeds the vapour pressure.

Although it is generally assumed that gases exert no influence on one another, this is not exactly so. Substances volatilize more readily in air than in a vacuum, and, conversely, we know from what has already been said that the dew point is lowered by the presence of gases with the vapours. If we follow the course of the gas from the holder to the compressors and on into the mains, some idea may be obtained of the most likely points at which condensation may occur. The gas leaving the holders, before entering the compressors, is completely free of visible vapours or cloud. It may contain about 3·5 per cent. of the illuminating constituents, consisting chiefly of ethylene and propylene, with perhaps 0·5 per cent. of benzene and naphthalene. The only condensable gases present are these last two constituents, together with heavier oils. On entering the compressors, the gas is raised in temperature in proportion to the pressure attained. The gas is released into the mains, where it immediately begins to cool and most of the condensation occurs—usually within a short distance of the compressors.

The following table gives the result of a fractional distillation of the syphon liquor taken from the 24-inch high-pressure main in Birmingham within a few yards of the compressors. The condensed water had previously been run off.

TABLE II.—*Fractional Distillation of Syphon Liquor from High-Pressure Main.*

[Sp. gr. ·8597. First drop at 73° C.]

Deg. C.	Per Cent.	Deg. C.	Per Cent.
73—100	9·5	170—180	10·9
100—110	3·5	180—190	6·3
110—120	4·0	190—200	2·5
120—130	7·1	200—210	1·9
130—140	10·1	210—220	1·0
140—150	11·6	220—230	0 8
150—160	10·6	Above 230	7·3
160—170	12·4	Residue	0·5

As the gas passes through the mains to the services, its pressure becomes reduced, and the gas is less saturated with benzene, water vapour, &c., than it was immediately after compression. How are these illuminants affected? We have defined vapour tension and shown the difference between a gas and a vapour. Let us for a moment consider Dalton's laws relating to a mixture of a gas and a vapour.

1.—The pressure exerted by, and the quantity of vapour which saturates, a given space are the same for the same temperature, whether this space is filled by a gas or is a vacuum.

2.—The pressure exerted by a mixture of a gas and a vapour, or of two gases, is equal to the sum of the pressures which each would exert if it occupied the same space alone.

The first law may be verified by introducing a few drops of water into a barometer tube in which the mercury stands at 30 inches and the temperature is 59° Fahr. The mercury will be depressed by about 0·5 inch by the water vapour formed. If the same water be allowed to evaporate into a space containing air or any other gases—instead of into a vacuum—the same thing happens, although at a much slower rate. Here we have the opposite effect to condensation taking place. We saw that vapours condense at a lower temperature when mixed with other gases—so liquids which are vaporizing do so at a slower rate when other gases are present. The second law may be illustrated by taking a mixture of benzene and water in equal proportions.

Then the pressure of the vapours contained in a gas that has been saturated by these two liquids which are not miscible is the sum of the vapour pressures of benzene and water at the temperature at which the gas was saturated. This mixture, having a vapour pressure at 50° Fahr. of 1·76 inches for benzene and 0·36 inch for water, shows a vapour pressure for the mixture of 2·14 inches. Where liquids are miscible in all proportions, the combined vapour pressure is about the mean of the vapour pressures of the constituents—*e.g.*, a mixture of 50 per cent. toluene with vapour pressure at 50° Fahr. of 0·41 inch, and a mixture of 50 per cent. benzene with vapour pressure at 1·78 inches gave a combined vapour pressure at that temperature of 1·16 inches. These are figures taken from a paper by J. A. Rafferty and H. E. Bates, of Chicago. Where two liquids partially dissolve one another, the vapour tension of the liquid mixture is less than the sum of the vapour tensions of each liquid taken separately at the same temperature.

From these illustrations, it may be concluded that although a gas may be saturated with one vapour, it is still able to take up the vapours of other liquids which do not dissolve each other or the liquid of the original vapour. Where the liquids are soluble in each other, such as benzene and toluene, the saturation of the gas with their vapours reduces the capacity of the gas for carrying vapours of higher tensions, since the increase in tension due to the addition of the new vapour is not as high as the tension of the last vapour if it existed alone. A gas saturated with a mixture of vapours of low vapour tension may be enriched by means of vapours of high tension, but a gas saturated with a mixture of vapours of high vapour tension will have its mean vapour tension decreased by the addition of vapours of lower tension.

Suppose we consider the case of the enrichment of a gas saturated with hydrocarbons by means of benzene. Benzene is a liquid of high vapour tension, and will withstand low temperature. If the hydrocarbons have a vapour pressure equal to that of benzene vapour, no enrichment will occur, because the tension necessary for the saturation of the gas with vapour is already present. If the hydrocarbons have a vapour tension higher than that of benzene, a loss of illumination may actually occur, due to supersaturation. It is only where the enriching liquor has a vapour tension higher than that of the saturated hydrocarbons in the gas that enrichment can occur.

At this point, I think it will be well to refer in some detail to a number of investigations that have been carried out on the effect of compression on the quality of coal gas. So far back as 1885, Mr. C. E. Botley, in his presidential address before the Southern District Association of Gas Engineers, published the results of valuable experiments on the compression of a gas of 16 and 17 candle power to pressures ranging between 45 lbs. and 200 lbs. to the square inch. Table III. summarizes his results.

TABLE III.—*Experiments on the Loss in Illuminating Power of Coal Gas when Compressed. (From Tests by Mr. C. E. Botley, 1885.)*

[Capacity of cylinder used for experiments, 170 cubic feet normal.]

No. of Experiment.	Illuminating Power of Gas before Compression.	Gas Compressed to Atmospheres. 3	4	5	6⅔	8½	10	13⅓
		Pounds per Square Inch. 45	60	75	100	125	150	200
	Cand.							
1	16·32	16·00	15·75	15·50	15·18	14 50	14·20	13·58
2	16·90	16·45	16·10	15·75	15·40	14·90	14·60	13·95

It will be seen that at 45 lbs.—or three atmospheres—pressure the candle power of the gas was reduced by about 2 per cent., while at 200 lbs. pressure by almost 17 per cent. It would appear that the higher the candle power the greater is the percentage loss; the quantity of illuminants remaining in the gas in each case at the same compression keeping approximately the same. It was also found, as one would expect from what I have already said, that the gas had the power of re-absorbing the hydrocarbons which had been compressed out, as the pressure was reduced.

At the Lübeck Travemunde high-pressure installation, it was found that the candle power of the gas decreases with increases in pressure, and it reaches a maximum when the gas is cooled to a low temperature. For pressures up to 6 lbs. to the square inch the loss in candle power was about 4 per cent., while the loss of B.Th.U. only reached about 1 per cent.

This raises an interesting point. The condensation of the higher hydrocarbons in high-pressure transmission affects the candle power to a very much larger degree than it affects the thermal value of the gas. This was to be expected, as the whole of the illuminating value of the gas is entirely dependent on what are known as the "illuminants," and these are the constituents most readily condensed. On the other hand, the thermal value of the gas is obtained from most of the remaining constituents of the gas, very little indeed coming from the illuminants—their volume being comparatively small.

The next table gives the calorific value in B.Th.U. of 1 cubic foot of each of the gases named; the gas being measured at 30 inches mercury and 60° Fahr.

TABLE IV.—*Calorific Values of One Cubic Foot at 30 Inches and 60° Fahr.*

	B.Th.U. Gross.		B.Th.U. Net.
Methane (CH_4)	991·5	..	889·8
Ethane (C_2H_6)	1732·0	..	1580·0
Propane (C_3H_8)	2472·0	..	2220·0
Ethylene (C_2H_4)	1557·0	..	1459·0
Propylene (C_3H_6)	2301·0	..	2150·0
Acetylene (C_2H_2)	1451·0	..	1398·0
Benzene (C_6H_6)	3737 0	..	3585·0
Hydrogen (H_2)	319·7	..	269·4
Carbon monoxide (CO)	317·8	..	317·8

Although benzene has such a high calorific value compared

with other gases, a small drop of (say) 0·35 per cent., while reducing the illuminating power by about 1 candle, amounting to about 6 per cent. reduction on the total candle power, reduced the thermal value of an average coal gas by, at the most, 0·75 per cent. For example, supposing that the coal gas in question has a composition of

CO	9·0 per cent.
CH_4	33·9 ,,
H_2	39·04 ,,
C_2H_4	3·412 ,,
C_6H_6	0·488 ,,
Other constituents, non combustible	14·16 ,,

A cubic foot of this gas will have a calorific value of 560·4 B.Th.U. This is calculated from Table IV. If, by compression, 0·35 per cent. of the benzene is condensed, then the percentage composition becomes—

CO	9·07 per cent.
CH_4	34·02 ,,
H_2	39·17 ,,
C_2H_4	3·4 ,,
C_6H_6	0·162 ,,
Other constituents	14·178 ,,

The effect of compression on the thermal value can be seen from the fact that before compression the illuminants contained 12·65 per cent. of the total thermal value of the gas, and the non-illuminants 87·35 per cent.; after compression, the illuminants contained 10·7 per cent. of the total thermal value of the gas, and the non-illuminants 89·3 per cent. A cubic foot of this gas has a calorific value of 550·22 B.Th.U.—a reduction of about 0·5 per cent. having occurred in the thermal value; while the candle power would have been reduced by at least 4 per cent.

While there is a candle power standard for coal gas, the question of condensation of the illuminants is a more or less serious matter, depending on the degree of compression to which the gas has been subjected. No doubt the time is quickly coming when this standard will be dropped and the thermal standard substituted.

High-pressure gas is used mainly for high-pressure lighting, and in industrial processes. In either case, the calorific value is all that is required. The difficulty arises where the high-pressure mains are used for boosting-up the low-pressure mains in largely expanding out-districts. Then the candle power standard must be maintained until the flat-flame burner is completely abolished. Under these circumstances, means might be devised for enriching the gas with illuminants locally at points where the governing down to the low-pressure mains occurs. If this were possible, then there would be no further need for the candle power standard for gas distributed at high pressure.

The work of Mr. E. C. Jones, published before the American Gas Institute in 1906, is well worth examining. He deals with the effect of compression on the chemical and physical properties of lighting gas. The gas was made from 14° Baumé California crude petroleum. It was a well-fixed gas, and resembles coal gas so closely that (as Mr. Jones says) it might be taken for an artificial coal gas. Its specific gravity was ·43, and it contained 626 B.Th.U. per cubic foot. Samples of this gas were taken and subjected in turn to increments of compression of 30 lbs. to the square inch. The same gas was never used for two compressions. After each compression, analysis and photometer tests were made. The results are given in Table V.

TABLE V.—*Effects of Compression on the Chemical and Physical Properties of Lighting Gas made from Crude Oil Water Gas.*

[From tests by Mr. E. C. Jones, 1906.]

(1)

Lbs.	C_nH_{2n}.	CH_4.	H_2.	CO.	CO_2.	O_2.	N_2.	Sp. Gr.	B.Th.U.	C.P.
0	7·0	29·7	50·0	5·2	3·0	Tr.	5·1	·413	626	21·6*
30	6·8	29·8	50·1	5·4	2·8	Tr.	5·1	·411	625	20·0
60	6·8	29·6	50·2	5·5	3·1	0·1	4·7	·412	624	17·0
90	6·8	29·6	50·3	5·5	3·1	Tr.	4·7	·411	624	16·0
120	6·7	29·5	49·2	5·6	3·2	0·1	5·7	·422	618	15·0
150	6·7	28·8	51·3	5·5	3·3	0·1	4·3	·407	617	14·0
180	6·5	29·0	51·0	5·5	3·0	Tr.	5·0	·407	615	11·1
210	6·0	29·0	51·0	5·7	3·2	0 1	5·0	·408	607	9·6
240	6·3	29·0	51·0	5·4	3·2	0·1	5·0	·408	611	10·8
270	6·0	29·1	51·6	5·5	3·2	0·1	4·5	·403	610	6·2
300	5·7	30·0	51·4	5·6	3·0	0·1	4·2	·399	614	5·5†

* H_2S. 200 grains per 100 cubic feet. † H_2S *nil*.

(2)

Lbs.	C_nH_{2n}.	CH_4.	H_2.	CO.	CO_2.	O_2.	N_2.	Sp. Gr.	B.Th.U.	C.P.
0	8·4	27·5	50·3	5·0	4·0	0·2	4·6	·425	653	20·9
30	8·3	24·8	54·1	5·0	4·0	0·2	3·6	·402	635	20·8
60	6·0	23·6	55·5	6·8	3·8	0·2	4·1	·393	587	17·6
90	6·2	26·2	53·3	5·0	3·6	0·2	5·5	·401	606	11·5
120	6·4	24·0	55·6	5·0	3·6	0·2	5·2	·390	594	11·1
150	6·2	21·2	61·5	5·0	3·6	0·3	2·2	·348	580	9·7
180	5·8	24·4	57·3	4·8	3·2	0·2	4·3	·371	591	8·6
210	5·7	22·9	60·2	5·0	3·1	0·2	2·9	·349	584	7·2
240	5·4	23·0	59·4	5·0	3·1	0·3	3·8	·357	576	6·5
270	5·6	22·2	60·2	5·2	3·0	0·2	3·6	·352	575	5·8
300	6·2	22·8	58·0	4·8	3·2	0·2	4·8	·371	585	4·7

He states that the most remarkable effects of compression are the continuous reduction in candle power and the elimination of naphthalene and sulphuretted hydrogen. From an illuminating value of 21·6-candle power the gas dropped to 5·5 candles at 300 lbs., but had a candle power of 17 at 60 lbs. A 17-candle power gas of the same type compressed to 60 lbs. would be very little reduced in candle power. The effect was then tried of passing the gas that had been compressed to 300 lbs. over the liquor that had been condensed. The candle power rose from 5·5 to 29·3. To enrich this compressed gas, it is not necessary to scrub it with the liquor. It is required only that the gas should pass over the surface of the liquor at low pressure.

A further series of tests confirmed the first series. The greatest loss in candle power occurred, however, between 60 lbs. and 90 lbs., while in the first series it was between 30 lbs. and 60 lbs. This may be due to the fact that the candle power of the first gas was higher than that of the second, and had not the stability—its additional power being derived from illuminants more easily removed by compression. These results, although not obtained from experiments with coal gas, are none the less valuable to us. Taken in conjunction with other investigations on the effect of compression, one is almost tempted to suggest that the opposite effect is taking place here, during the process of condensation by increments of pressure to that which occurs in coal-tar distillation. In the latter process, the constituent oils are separated by a fractional distillation of liquor by continuous increments of temperature, the pressure remaining constant; the higher temperatures being required for the oils of higher boiling points and low vapour pressures. In the case of the condensation of the heavy hydrocarbons, it appears as if a fractional condensation were occurring by continuous increments of pressure; the temperature remaining, for all intents and purposes, constant. The higher pressures would bring down the vapours or mixtures of vapours of lowest vapour pressure. Immediately the partial pressure of the vapour exceeds its vapour pressure, the vapour will condense.

J. A. Rafferty and H. E. Bates, of Chicago, have gone very thoroughly into the question of the condensation of illuminants from carburetted water gas. They show that, in comparing the effect of compression on gases of high and low candle power, there was present an excess of ethylene in the former. This probably raised the vapour tension over that of the low candle power gas, causing less condensation to take place by the compression of high candle power gas than of low candle power gas. On the other hand, at lower pressures (5 to 10 lbs.) their curves pointed to a larger drop with the low candle power than with the high candle power gas.

These apparently divergent results lead them to the conclusion that the high candle power gas contains considerable amounts of hydrocarbons of complex molecular structure. The more complex the molecule, the higher are its illuminating qualities and the lower its vapour tension. Analyses showed that although the drop in illuminants was low at low pressures, the fall in candle power was high. The diminution in percentage of illuminants is therefore not proportional to the drop in candle power; and their statement is probably warranted that at low pressures the vapours of low tension are condensed, and these vapours are of complex structure and high illuminating value.

V. A. Haughton and S. L. Cole, in America, have carried through an investigation on the effect of compression on coal. Their general conclusions were very similar to those of Rafferty; but their method of arriving at them was very different. This lends an added confirmation for both sets of results. Their pressures ranged between 25 and 40 lbs. Determinations were made immediately after compression and at the end of a main 22 miles

away. No reduction, either in calorific value or in illuminating power, was observable immediately after compression; but at the station 22 miles away the candle power dropped from 16·9 to 15·9, and the thermal value from 661 to 642 B.Th.U. The drop in pressure over the 22 miles of 4-inch main was 5·8 lbs.

These experimenters determined the dew points of the hydrocarbon vapours. It was found by direct determination that the dew point temperature was much lower for the high-pressure gas than for the low-pressure gas. This agreed with the reduction in candle power. They showed that when high-pressure gas is cooled to a given temperature, hydrocarbons are condensed and the candle power is reduced; but when the same gas at low pressure is cooled to the same temperature, no hydrocarbons are condensed. The loss in the main is due to compression and reduction in temperature. The transmission losses, except those due to the latter causes, may be counted as *nil*. To sum up in brief, an average coal gas compressed to up to 40 lbs. to the square inch will suffer very little loss in candle power. The loss in B.Th.U. is still less. In either case, the temperature to which the gas is subsequently cooled is a leading factor, controlling the amount of condensation. The composition of the illuminants also largely controls their loss, and the effect of the loss on candle power.

Now that I have drawn your attention in a more or less general way to the subject of the effect of compression on coal gas in the mains, I wish to pass on to the consideration of the conditions governing the flow of gases at high pressures. Much valuable work has been done, and is now being done, on the subject; and most of the information at our disposal appears entirely reliable. Dr. Pole's formula, published in 1851, has proved eminently satisfactory for low-pressure gas; but as a means of calculating the size of mains requisite for the passage of a given volume of gas a given distance with an arranged drop of pressure, it cannot be relied on. This formula is obviously a modification of a well-known hydraulic formula.

$$Q = 1350\sqrt{\frac{p\,d^5}{S\,L}}$$ where

d is the internal diameter of the main in inches.
p „ pressure drop of gas in inches.
S „ specific gravity of gas (air = 1).
L „ length of main in yards.

For high pressures, the results obtained from it are too low. From this formula, the delivery increases in proportion to the square root of the pressure. In order to double the delivery from a given sized main, it would be necessary to raise the original pressure four times, and so on. This relation of delivery and pressure is not correct, however, with high pressures. Nearly all modern formulæ show that as the pressures are raised the delivery tends to become more and more in direct proportion to the initial pressure in the main—the outlet pressure remaining constant. As has frequently been pointed out, one of the chief advantages of the transmission of gas at high pressure is in this close but not direct relationship between pressure and delivery; the latter increasing at a much greater rate as the initial pressure is raised than Pole's formula indicates.

A lecture of enormous interest and value to the industry generally was that delivered by Professor Unwin before the Institution of Gas Engineers in June, 1904. The principles he then laid down have been amply substantiated since that time; and I am of the opinion that the gas industry owes him much for that lecture. Most of the information found in text-books on the flow of gas was both crude and vague. He pointed out that it had been the custom—almost universally recognized—to speak of gas as distributed at so many inches pressure. This is completely indefinite. The discharge depends entirely on the drop in pressure over a given length of main.

I notice that even now-a-days some writers, in using Dr. Pole's formula for low-pressure gas, take "p" as being the initial pressure; whereas it is meant to stand for the difference between the inlet and outlet pressures, or, better still, between the initial and final pressures. In low-pressure mains, the velocity of flow of the gases is rarely higher than 15 feet per second in large mains. Working with higher pressures and at greater velocities, it is possible to transmit much larger volumes of gas through smaller mains. Professor Unwin suggests that gas engineers will have to determine the friction factors in mains, as hydraulic engineers have had to do. Those who are desirous of tracing for themselves the building-up of the hydraulic formulæ, upon which all pneumatic formulæ are based, may do so by reference to Unwin's book "Hydraulics," or to the lecture to which I have referred.

In hydraulic formulæ, the difference in atmospheric pressure at two distant points in a main may be neglected in practical calculations. With pneumatic formulæ, this is not so. All pressures must be pressures absolute, whether expressed as pounds to the square inch or as feet of water. The hydraulic equations apply exactly to the flow of gas in pipes if the pressure variations are not large enough to bring about a considerable change in the volume of the gas. For example, if the pressures at the ends of a main are 6 inches water and atmospheric, the difference in pressure absolute will be 34½ feet less 34 feet of water, which amounts to a change in volume of only about 1½ per cent. in the gas. But where the perssure variations are much greater than these, the work done by the expansion of the gas must be taken into account, and hydraulic formulæ no longer hold. This is where Dr. Pole's formula fails.

Professor Unwin also draws attention to the effect of differences in elevation of the mains and of points where the pressures are measured. He shows that there are cases where the pressures shown on the syphon gauges are negative.

Perhaps the most useful part of Unwin's treatment of the subject was the stress he laid on the necessity for determining, as exactly as possible, the coefficient of friction for different sizes of pipes. So far as I have seen, he is still the only one whose formula contains a definite expression for the coefficient of friction, which varies with the size of the main. This coefficient varies with the roughness of the pipe; and as there is no standard of roughness, and as the effect of roughness is difficult to calculate mathematically, experimental data on the subject are still urgently called for. There is no reason to believe that this coefficient is different for gas than for water; but the figure that Dr. Pole took as the average for all cases was not accurate enough. It is now known that the coefficient is not constant. It is now certain that it varies with the roughness of the pipe and with the diameter of the pipe. It is greater for small pipes and smaller for large ones.

As a result of experiments carried out with compressed air mains in Paris, Unwin deduced the following formula—

$$\zeta = \cdot0044\left(1+\frac{1}{7d}\right)$$

where "d" is in feet. The smoother the mains are the smaller is ζ. This is one reason for the use of steel pipes. From this formula I have calculated the values for ζ for pipes of varying diameters. The other two columns contain the corresponding diameters of the main in feet and the areas in square feet. These have been included as a table of reference.

TABLE VI.—*Constants Used in Determining the Discharge of Gas from Mains by Means of Unwin's Formula.*

Diameter of Main in Inches.	Diameter of Main in Feet = d.	Area of Main in Sq. Feet = w.	Value of ζ = Coeff. of Friction = 0·0044 $(1 + \frac{1}{7}d)$.
2	0·166	0·021	0·0082
4	0·333	0·087	0·0063
6	0·500	0·196	0·0057
8	0·666	0·349	0·0053
12	1·000	0·785	0·0050
16	1·333	1·396	0·0049
18	1·500	1·767	0·0048
24	2·000	3·142	0·0047

Unwin's formulæ were compiled with a view to calculating the size of mains necessary for a given delivery under a given drop in pressure. He does not appear to state a formula for determining the quantity of gas delivered (Q). The following formula assumes isothermal expansion of the gas at a temperature of 60° Fahr.—*i.e.*, PV. = constant.

Then if u_1 = initial velocity of gas in feet per second.
d = diameter of pipe in feet.
S = density of gas (air = 1).
l = length of pipe in feet.
p_1 = initial pressure in lbs. per square inch absolute.
p_2 = final „ „ „ „ „
ζ = coefficient of friction = $0{\cdot}0044\left(1+\frac{1}{7d}\right)$.
u_2 = final velocity in feet per second.
w = area of pipe section in square feet.
Q = discharge in cubic feet per hour.

Then

$$u_1 = 468\sqrt{\left\{\frac{d}{\zeta S_1}\cdot\frac{p_1^2-p_2^2}{p_1^2}\right\}}$$

$$u_2 = \frac{p_1}{p_2}u_1$$

$$Q = 1{,}323{,}250\sqrt{\frac{p_1^2-p_2^2}{p}\left(\frac{p_1}{p_2}\right)^2\frac{d^5}{3l}}$$

The formula for "Q" has been deduced from the formulæ Unwin gives for "u_1"—the velocity in feet per second at the inlet of the pipe. These formulæ are sometimes awkward things to work out; so for the advantage of those who may have cause to use them, I have plotted the data out in tabular form for the calculation of the volume of gas delivered from 8-inch and 12-inch mains at 8 lbs. and 12 lbs. pressure respectively.

TABLE VII.—*Tabular Method of Plotting Data for Use with Unwin's Formula.*

Diameter of Main in Inches.	Diameter of Main = d Feet.	Area of Section = w in Sq. Feet.	Length of Main in Miles.	Co-efficient of Friction = ζ.	Inlet Pressure Absolute = p_1 Feet Water.	Final Pressure Absolute = p_2 Feet Water.	$\frac{p_1^2-p_2^2}{p_1^2}$	$\frac{p_1}{p_2}$	u_1 in Feet per Second.	Discharge = Q in Cubic Feet per Hour.
8	0·666	0·348	1	0·0053	52·5	34·0	0·5805	1·544	82 0	158,620
8	0·666	0·348	1	0·0053	61·75	34·0	0·6967	1·810	89·84	203,710
12	1·000	0·785	1	0·0050	52·5	34·0	0·5805	1·544	103·5	451,630
12	1·000	0·785	1	0·0050	61·75	34·0	0·6967	1·810	113·34	579,725

The most important point to be noted is that the pressures are expressed as absolute pressures. It will be seen that there is no directly proportional connection between the pressure and the volume of gas delivered, as is sometimes believed.

Quite recently, a number of formulæ have been published relating to the flow of gas through mains. In all cases these are stated to agree very closely with the results of experiments carried out by the experimenters concerned. The chief differences between most of them are in their methods of notation, and in the way in which the mass of figures connected with their deduction, either from first principle or from hydraulic formulæ, is boiled up and presented in a convenient form.

By the Peoples Gaslight and Coke Company of Chicago the following formula is used:—

$$Q = 64{\cdot}3\sqrt{\frac{d^5 P m}{WL\left(1 + \frac{3{\cdot}6}{d} + 0{\cdot}03d\right)}}$$

where

Q = discharge of free gas cubic feet per hour at 62° Fahr. and 30 inches mercury.
d = diameter of pipe in inches.
P = friction pressure drop, lbs. per square inch.
m = average pressure (initial *plus* final, pounds absolute ÷ 2).
W = specific gravity of gas, air = 1.
L = length of pipe in miles.

This formula is found to agree very closely with what has been found in actual practice in Chicago for long lengths of pipes.

Another formula worthy of note is that published in the French Commission's report on High-Pressure Distribution ["JOURNAL OF GAS LIGHTING," Sept. 26, 1911, p. 802]. They state that the Monnier-Pole formula is always applicable. This has the form

$$h = 660\,M\,\frac{ISQ_2}{d^5}$$

where

h = loss of pressure in mm. water.
I = length of main in metres.
M = coefficient of friction (0·003).
S = density of the gas.
Q = output in cubic metres per hour.
d = diameter of main in centimetres.

The Commission's report states that it had been found that M varied between 0·00295 and 0·0033, depending on the pressure.

This is a formula for Q deduced from the Monnier-Pole formula, with the notation changed from the metric system to that adopted in Unwin's formula.

The work of Dr. Blaess (just published), on the flow of gases in pipes, should prove of immense value to all interested in this subject. He discusses very fully all the then existent formulæ known to him for the flow of gases in pipes. It occurred to me it might be interesting for me to compare these formulæ and determine how closely they agreed under varying conditions.

The following are formulæ for Q deduced from the formulæ of Blaess, Monnier-Pole, and Chicago, with their systems of notation converted to the English form, so that they shall all be in line with Unwin's formula. We then get

For Unwin's formula $Q = \frac{w \cdot p_1 \cdot u_1}{p_2} \times 3600.$

For the Monnier-Pole formula $Q = \sqrt{\frac{hd^5 \times 10^{11}}{2{\cdot}0118\ \text{S.M.I.}}}$

where

Q = discharge in cubic feet per hour.
h = loss of head in feet of water.
S = density of the gas.
M = coefficient of friction (0·003).
d = diameter of main in feet.

The Chicago formula has already been given. The Blaess formula is—

$$Q = \sqrt{\frac{H\,d^5 \times 10^{12}}{2{\cdot}5124 \times \gamma\, l\, \lambda}}$$

where λ = coefficient $= 0{\cdot}0125 + \frac{0{\cdot}0036}{D}$

d = diameter of main in feet.
H = loss of head in feet of water.
l = length of main in feet.
γ = density of gas (air = 1).
Q = discharge in cubic feet per hour.

To compare these formulæ, I calculated the volume of gas in cubic feet per hour delivered through 8-inch and 12-inch mains of running length 1 mile at 8 lbs. and 12 lbs. pressure at the inlet and escaping to atmosphere. The specific gravity of the gas was taken as ·45.

It will be seen from the results of these calculations (as shown in Table VIII.) that, although these formulæ do not agree exactly, their divergence from a practical point of view is not serious. The Monnier-Pole formula gives the most divergent results, while the remaining three agree remarkably well.

On comparing the formulæ themselves, it will be seen that they all agree fundamentally, in that the discharging capacity of the main varies—

(1) As the 2·5 power of the diameter.
(2) As the square root of the lost head.
(3) And inversely as the square root of the density of the gas.
(4) And inversely as the square root of the length of the main.

The only real differences occur in the values of the constants employed.

TABLE VIII.—*Delivering Capacity of Mains of Eight and Twelve Inches Diameter, of Running Length One Mile, as Computed from the following Formulæ.*

[Sp. gr. of gas = ·45.]

Diameter of Main in Inches.	Initial Pressure, Pounds per Square Inch Gauge.	Final Pressure, Pounds per Square Inch Gauge.	Delivering Capacity in Cubic Feet per Hour by Unwin's Formula. $Q = 1{,}322{,}250\sqrt{\frac{p_1^2 - p_2^2}{p}\left(\frac{p_1}{p_2}\right)^2 \frac{d^5}{SL}}$	Delivering Capacity in Cubic Feet per Hour by Monnier-Pole Formula. $Q = \sqrt{\frac{hd^5 \times 10^{11}}{2{\cdot}0118\ \text{S.M.I.}}}$	Delivering Capacity in Cubic Feet per Hour by Peoples Gaslight and Coke Company's (Chicago) Formula. $Q = 64{\cdot}3\sqrt{\frac{d^5 P m}{WL\left(1 + \frac{3{\cdot}6}{d} + 0{\cdot}03d\right)}}$	Delivering Capacity in Cubic Feet per Hour by Blaess' Formula. $Q = \sqrt{\frac{Hd^5 \times 10^{12}}{2{\cdot}5124 \times \gamma l \lambda}}$
8	8	0	159,200	130,020	158,625	150,650
8	12	0	426,360	159,230	204,400	184,460
12	8	0	204,460	359,175	404,530	438,730
12	12	0	547,570	439,900	521,380	537,340

It will be noticed that in the case of Unwin's formula and the Chicago formula, the coefficient of friction is expressed in terms of the diameter, whereas in the case of the Monnier-Pole formula a mean value of 0·003 is given, which appears to be somewhat low. The constants used in Unwin's formula have been slightly altered from time to time as a result of a large number of experiments which have been carried out in connection with the transmission of air and other gases—the constant 472 being frequently adopted in place of 468. The formula as presented appears to give the best results as compared with those obtained in actual practice, and might be adopted as a standard formula. Where mains have been used for some time, the Monnier-Pole formula might be employed with advantage, on account of the margin allowed by its use.

Whatever formula is adopted, however, suitable allowance should be made for the effects produced by tees, elbows, and bends, as the loss of head thus produced would be considerable when the velocity of gas in the mains was high, as in the transmission of large quantities of gas through small pipes.

I have been unable to obtain any reliable data on the effects of bends. Numerous suggestions have been made relating to the possibility of expressing them as equivalent to a given length of pipe of the same diameter, the length depending on the angle of the bend. Something might be worked out on these lines, but so far I am afraid I do not see how.

I have by no means exhausted the subject of the transmission of gas at high pressure—in fact, I have but touched the fringe of the subject.

Experiments on a large scale are now being organized in Birmingham on the flow of gases through the city mains. With a 7-mile length of 12-inch main with few bends, and with a network of other mains, of sizes ranging from 24-inch down to 8-inch, some useful data should be forthcoming.

In December, I intend dealing with the subject of the theory and practice in the application of high-pressure gas. I hope then to demonstrate to you a few of the applications of high-pressure gas, and give you some of the latest data I shall then have at my disposal on the subject.

REFERENCES TO HIGH-PRESSURE DISTRIBUTION.

[J.G.L. = "Journal of Gas Lighting." G.W. = "Gas World."]

DISTRIBUTION.

Distribution of Gas at High Pressure. By Ch. D'Aubenton-Carafa. J.G.L., Aug. 4, 1908, p. 316.

Distribution at High Pressure and Flow of Gas in Mains. By Professor Unwin. J.G.L., June 21, 1904, pp. 852 and 929.

Gas Distribution at Increased Pressure. By C. Carpenter. J.G.L., June 25, 1907, p. 996.
High-Pressure Distribution. By Herr Blum. J.G.L., July 11, 1911, p. 102; July 18, 1911, p. 156.
High-Pressure Distribution, Bryan Donkin's Pamphlet on. J.G.L., Oct. 6, 1908, p. 28.
High-Pressure Distribution. By J. D. Keillor. J.G.L., Aug. 4, 1908, p. 305.
High-Pressure Distribution. By J. Mitchell. J.G.L., Jan. 10, 1911, p. 104.
High-Pressure Distribution. By H. L. Rice, of Aurora (Ill.). J.G.L., Dec. 5, 1905, p. 679; Dec. 12, 1905, p. 750; Jan. 2, 1906, pp. 40 to 42; Jan. 9, 1906, p. 107.
High-Pressure Distribution. By A. Robinson. J.G.L., Jan. 11, 1910, p. 103.
High-Pressure Distribution. By F. H. Shelton. J.G.L., Vol. LXXIX. (Jan. to June, 1902), pp. 765, 891, and 1420.
High-Pressure Distribution in—
America (U.S.A.). By E. C. Jones. J.G.L., Oct. 22, 1907, p. 259.
America. J.G.L., July 9, 1907, p. 92.
America, Development in. By R. M. Searle. J.G.L., June 25, 1907, p. 936.
California. By E. C. Jones. J.G.L., Sept. 27, 1904, p. 885.
Cherokee (U.S.A.) G.W., July 29, 1911, pp. 122 and 131.
London. G.W., Jan. 24, 1911, p. 239.
Newport (Mon.). By T. Canning. J.G.L., April 21, 1908, p. 149.
Nuneaton. J.G.L., March 1, 1904, p. 539.
St. Louis. J.G.L., July 19, 1904, p. 181; Feb. 16, 1904, pp. 405 and 406.
Stockport. By C. H. Webb. J.G.L., Oct. 27, 1908, p. 267.
Teignmouth. J.G.L., May 9, 1911, pp. 354 and 375; G.W., May 13, 1911, pp. 583 and 590.
High-Pressure Distribution for Commercial Purposes. By H. M. Moore. J.G.L., Sept. 14, 1909, p. 695.
High *v.* Low Pressure Gas Distribution. By H. W. Frund. J.G.L., Sept. 13, 1910, p. 723.
High-Pressure Distribution Problems. By L. H. Johnson. J.G.L., May 17, 1910, p. 440.
Places, List of, with High-Pressure Gas, with brief descriptions of same. By H. L. Rice, of Aurora (Ill.). J.G.L., Jan. 2, 1906, pp. 40 to 42; Jan. 9, 1906, p. 107.

FLOW OF GASES.

Formulæ for Flow of Gases in Pipes. By Lowe. J.G.L., Oct. 11, 1904, p. 113.
Flow of Gases at High Pressure. G.W., July 22, 1911, p. 112.
Transmission of Gas through High-Pressure Mains to a Distance. By Herr A. Lenze. J.G.L., Aug. 31, 1909, p. 564.
Flow of Gas in Mains and Distribution at High Pressure. By Professor Unwin. J.G.L., June 21, 1904, pp. 852 and 929.
Flow of Gases in Pipes. By Dr. Viktor Blaess. J.G.L., Aug. 1, 1911, p. 291.

SUPPLY.

High-Pressure Supply in—
New Zealand. By F. C. Suggate. J.G.L., Jan. 7, 1908, p. 39.
Los Angelos. By C. A. Luckenbach. J.G.L., Oct. 20, 1908, p. 207.
Birmingham. J.G.L., June 14, 1910, p. 707, and Nov. 1, 1910, pp. 308 and 313.
America (U.S.A.) List giving places with high-pressure gas, miles of mains, &c. J.G.L., Aug. 2, 1910, p. 326.
High-Pressure Supply, A Few Notes on. By A. Waddell. J.G.L. Aug. 4, 1908, p. 308.
Long-Distance High-Pressure Gas Supplies. By Herr V. Schrevel. J.G.L., Aug. 25, 1908, p. 507.
Long-Distance Gas Supply on the Continent. By Herr Menzel. J.G.L., Nov. 30, 1909, p. 605.

MISCELLANEOUS.

Effects of Compression on Coal Gas. By J. A. Rafferty and H. E. Bates. Paper presented to the Illinois Gas Association March 17 and 18, 1909.
Effects of Compression on Coal Gas. By V. A. Haughton and S. L. Cole. Paper presented to the Illinois Gas Association March 17 and 18, 1909.
Loss in Illuminating Power of Coal Gas when Compressed. C. E. Botley, in his Presidential Address to the Southern District Association of Gas Engineers in 1885.

DEVELOPMENT IN CARBONIZATION METHODS: HORIZONTALS, VERTICALS, OR CHAMBERS?

By G. STANLEY COOPER, B.Sc., F.C.S.

IN previous articles, the writer has given accounts of the development of various methods of treatment of bye-products, including the recovery of ammonia by the direct method, and also the recovery of benzol from crude gas. These are practically entirely in operation on coke-oven works, and one can expect in a few years' time to see great developments along similar lines in gas-works. The Burkheiser process is being watched with interest all over the country; and a Glasgow deputation has visited Germany with the object of investigating its commercial worth.

There seem to be three groups in which the interest in carbonization is centred at present; and these represent each in itself a different stage of development. A few years ago, it was said that horizontal retorts were played out. With the introduction of the latest types of power stoking machines, the horizontal retort has entered upon a new lease of life; and for very good reasons, too, a fact which is sometimes apt to be overlooked. For years, this type of retort was practically the only one in existence, and consequently its construction and working received a great deal of attention. This meant that the furnace arrangements and all working details reached a very high standard, and very little (if any) room was left for improvement. Now all the attributes of the furnaces, &c., for horizontals cannot be similarly reproduced with verticals. New considerations and circumstances arise; and these will only be dealt with, with absolute satisfaction, after a few years' experience and experiment. Almost every possible set of circumstances or conditions has already been met with in the case of horizontals, while verticals may present new problems which, to the inexperienced mind, mean new difficulties. Again, horizontals fitted with the latest stoking machinery, coke-conveyors, &c., are actually producing very good results indeed; and this will probably keep many engineers who are contemplating extensions or renovations true to the old love.

The second stage of the development is the use of vertical retorts working either on the continuous or on the intermittent system. This represents a resuscitation of an old idea but with modern adornments and improvements. But—to the present generation at least—it is new; and this alone in the minds of many gas engineers causes it to be viewed with a certain amount of suspicion and apprehension. These same men are quite appreciative of the good results obtained with installations of verticals; and they even wax enthusiastic over the installation—on someone else's works. The adoption of vertical retorts in place of horizontals means an entire change of system and control; and this in itself is an antagonistic factor to their general adoption. The change will come to a certain extent, but it will be a very slow one because of its magnitude. It is more than a change in design; it is one in principle. While in Germany recently, the writer had a conversation with a very prominent engineer and authority on these matters; and he was firmly of the opinion that, without considerable modification, verticals would never be largely adopted. One of his chief objections was to the height of the retort. It is a matter of great difficulty--so he said—to maintain satisfactory heating of a retort the height of the usual verticals; and it is in this connection that he anticipated trouble. He advocates a large reduction in height and a corresponding increase in diameter—thus approximating somewhat to chambers of small size. However, authenticated results at Lausanne, Sunderland, and elsewhere show that here at any rate the installations have met with a high degree of success. One great advantage urged on behalf of verticals—*i.e.*, the diminution in labour costs compared with horizontals—is much minimized when compared with power stoking and horizontals, for here the power machine can do the work of several men.

The third stage in the development is one which is not met with to any extent in this country—that is, chamber carbonization. Of this system, two principal modifications exist; the inclined chambers and the horizontal chambers. At Berlin on the Tegel works, there is an installation of inclined Munich chambers; while at Vienna (Simmering), there is a set of Koppers inclined chambers, and also an installation of horizontal chambers by the same makers. This opens up the question of carbonization in bulk, and a very important section it is. With gas-making as the sole object, bulk carbonization is comparatively a new thing; but all working details have been brought to a high standard of perfection on coke-works, where the making of furnace coke is the chief aim. Here the methods of charging and discharging the chambers, regulating the heating of the furnaces, and such like details, together with the erection of the most suitable types of machines, have been the object of much care and experiment. The change from coke making to gas making is not a very big one, and at any rate constructional details need little, if any, modification.

With regard to the inclined chamber installation, at Vienna at any rate, Herr Koppers, the builder, has decided not to build any more, as he can obtain better satisfaction from horizontals. At Berlin, too, the writer gathered that the working was not entirely satisfactory. Theoretically, with inclined retorts, when the discharging door is opened, the coke needs practically no attention to discharge. Unfortunately this is not quite true in practice, as "sticking" seemed to be quite a common occurrence, and it is no simple or safe task to "tickle" 8 or 10 tons of red-hot coke and cause it to slide down the chamber.

In the horizontal system, the principle of construction is the same as that for coke-ovens. The chambers take a charge of 8 to 12 tons of coal, and this is carbonized for 24 hours. The machinery necessary can deal easily with this amount of coal and coke formed, and labour costs are small. At Vienna, certainly, satisfaction must have been given to the authorities, for a further installation of 72 ovens, each of 10 to 12 tons capacity, is now under construction by Messrs. Koppers. A photograph of this installation appeared in the "JOURNAL" for Sept. 5.

It is in connection with chamber carbonization that the writer anticipates the greatest development in the future on gas-works. Undeniably, development of bye-product treatment will accompany changes in carbonization, and what offers so easy a way to development as chamber carbonization? Coke-ovens are in operation where the direct-recovery of ammonia is successfully practised, and where also benzol is recovered. It will not be a matter of great difficulty to adapt this system to gas-works.

Without doubt great changes are coming; and it will not be safe to say that any of the three systems will win, as each has very strong claims to support.

MANCHESTER UNIVERSITY LECTURES.

Opening of the Session.

The first of a series of lectures arranged for the winter session at the Manchester University in continuation of the movement originated at the beginning of last year by the Manchester and District Junior Gas Association, and supported by the Manchester District Institution of Gas Engineers, was delivered on Saturday afternoon in the chemistry theatre of the University by Mr. E. W. Smith, M.Sc. (Manchester), of the High-Pressure Gas Laboratories, Birmingham, who had for his subject "High-Pressure Gas Distribution." There was a large attendance of members of the two Manchester Gas Associations; the chair being occupied by Sir ALFRED HOPKINSON, the Vice-Chancellor of the University.

The CHAIRMAN, in opening the proceedings, said that he should like to state, in the first place, on behalf of the University, the great satisfaction it had given them to again be able to arrange a course of lectures along with the two Manchester Gas Institutions. He was quite sure that as knowledge advanced, and as the problems which presented themselves became more and more complicated, there would be a greater desire for co-operation between those who devoted themselves to what he might call the side of pure science in our Universities and those who were engaged in the industrial and manufacturing sections of great undertakings being carried on by the Government and municipalities. He was pleased to see such a large attendance; and it was an additional pleasure to him to welcome to Manchester Mr. Smith, who was an old student of the University now engaged on important work for the Corporation of Birmingham, about which he would explain shortly in his address. Before calling upon Mr. Smith to give his lecture, he wished to express, on behalf of Professor Dixon, his great regret at being unable to be present. Professor Dixon had taken a very active part, along with representatives of the two Gas Institutions, in organizing these lectures; and he would certainly have been present were it not that he was engaged on very important public duties—investigating for the Home Office with a view to the prevention of explosions in mines.

Mr. SMITH then proceeded to give his lecture, which is reported on p. 105.

Mr. D. V. HOLLINGWORTH, F.C.S., in moving a vote of thanks to the lecturer, said their congratulations were due to Mr. Smith, not only for the choice of subject, but for the extremely clear and lucid manner he had dealt with it for their benefit. The very large attendance they had that afternoon warranted the choice which had been made, and also the action of the Sub-Committee in arranging for a further course of lectures. Speaking as one of the Sub-Committee, he was delighted to find that their efforts had met with such a large response; and it was an encouragement to the Committee to make further and more important efforts in the same direction. It had been said that the Manchester Junior Gas Association aimed very high in this matter—too high, in fact. He did not think so. He did not consider they had aimed high enough; and as far as lay in his power, he would push on to a yet higher grade. They could not afford to stand still—they must go forward or they would be left behind. He had risen not only to move a vote of thanks to Mr. Smith for his lecture, but to ask those present to give every encouragement to the lectures, and persuade as many of their friends as possible to join.

Mr. S. MEUNIER (Stockport) seconded. He was quite in accord with Mr. Hollingworth when he said they ought to aim as high as they could. At the same time, they sometimes differed in regard to the steps that should be taken to attain the high object they had in hand. They made a start last year in a rather humble way; but the members of the Committee felt so satisfied with the results that they were bound to continue the efforts and improve upon them as much as they could. He thought the choice of subjects good, and that for the opening lecture was a particularly happy one. High-pressure distribution was coming to the front very much, and had been so for some time. Incidentally he mentioned that Stockport was perhaps the second place in the country to undertake this class of work—Mr. George Helps, of Nuneaton, being the first, he believed. There was not the slightest doubt that one of the "big lines" of the future in the gas industry would be the supply of high-pressure gas for lighting and industrial purposes; and it would be a line that would bring a satisfactory improvement to their gas-rent roll.

The motion having been carried with applause,

Mr. SMITH responded. In the course of his remarks, he said he liked criticism and asked for it, because, in his opinion, it was only by criticism that anything new could be brought out. The more criticism he had of the right kind in connection with his work the more pleased would he be.

Mr. S. GLOVER (St. Helens) moved a vote of thanks to Sir Alfred Hopkinson for presiding, and at the same time desired to say, on behalf of the members of the two Associations, that they very much appreciated the kindness of the Vice-Chancellor and the help he had given in arranging the course of lectures.

Mr. A. L. HOLTON (President of the Junior Gas Association) seconded. It seemed to him from the gathering that afternoon, and the attendance they had at those given last session, that the lectures were filling a long-felt want. If they wanted further proof that they had done the right thing, they had it in the fact that the Midland Junior Association had taken a leaf out of their book, and were going to try and arrange a similar course of lectures. There was an old saying that "what Lancashire thinks to-day the rest of England thinks to-morrow." In passing, he desired to call the attention of those present to the fact that the reports of these lectures were included in the printed proceedings of the Junior Associations. Unfortunately all those for last year had been sold. If any member of the Senior Association would like to have a copy of the Junior Association's proceedings, including the University lectures, he should give his name to Mr. Alsop, the Hon. Secretary, so that a copy for next year could be reserved for him.

The resolution was carried with much enthusiasm.

The CHAIRMAN, in acknowledgment, said it was a matter of great gratification to him, and to the University, to have such a large assembly as they had that afternoon of members of the two Associations, and to see the real interest they were taking in the important work they were engaged in.

This concluded the proceedings in the chemistry theatre; but most of those attending the lecture proceeded subsequently to the engineering departments of the University, for the purpose of witnessing some demonstrations as to the flow of gases and water through pipes, and how pressures and velocities are ascertained, with other interesting data appertaining to this subject.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Opening Meeting for the session of this Association was held on Saturday evening, in the Glasgow and West of Scotland Technical College. There was a large attendance.

Mr. J. FRAZER, the retiring President, took the chair; and, after returning thanks for the support the members had given him during his year of office, he nominated Mr. J. M'Ghee, of Glasgow, as his successor.

The nomination was accepted, and Mr. M'Ghee took the chair.

CLASSIFICATION OF MEMBERS.

A Special Committee appointed last session recommended that the membership be divided into three classes—members, honorary members, and patrons. Honorary members to pay 7s. 6d. yearly and ordinary members 5s.

Mr. FRAZER objected to increasing the subscription of honorary members. If there was any honour in elevating a man to this position, he said, it would be greater if they did not charge any fee. As far as they had asked subscriptions for the President's Medal proposed to be instituted, the honorary members had responded heartily. Indeed, five-eighths of all the money subscribed had come from them.

The PRESIDENT thought they should take the two points of the recommendation separately, and first decide as to the degrees of membership.

Mr. D. FULTON said he understood that whatever was done regarding honorary members, it should not be retrospective—that it would still be optional on those at present on their list to pay or not to pay as they desired. If the rule was passed as it stood now, they would have honorary members who were expected to pay, but from whom they could not demand anything, and others from whom they did demand a subscription. It would be better if they kept these members apart. He moved that there be four bodies—members, honorary members, extraordinary members, and patrons.

Mr. J. FRAZER seconded.

Mr. A. H. WHITELAW (Glasgow) pointed out that the Committee, consisting of four ordinary members and four members of Council, came to a unanimous finding. He was quite prepared then to propose that the division be patrons, members, and associate members; but he was talked out of this, and understood it would not be out of place to charge honorary members 7s. 6d. If there was to be an alteration, he would move that there be patrons, members, and associate members, and blot out honorary members altogether.

Mr. J. ALLEN (Glasgow) seconded.

Mr. J. WILSON (Falkirk) pointed out that they were a Junior Association, but if they made associate members they would bring themselves into line with the North British Association, which was not what they wanted.

Mr. W. M. MASON (Glasgow) moved that the original rule be continued; but this was not seconded.

On a vote being taken between Mr. Whitelaw's amendment and that of Mr. Fulton, the latter was carried; but eventually the recommendation of the Committee became the finding of the meeting. The rule has therefore been changed to include patrons. The recommendation to increase the subscription of honorary members from 5s. to 7s. 6d. was defeated.

ELECTION OF VICE-PRESIDENT.

The next business was the election of a Vice-President. Messrs. F. L. M'Laren (Dumbarton) and Mr. John Wilson (Falkirk) were nominated; and on a ballot, the former was declared elected. Mr. George Braidwood (Coatbridge) was unanimously elected a member of Council in room of Mr. M'Laren.

President's Medals.

The President said that, with regard to the fund for the President's Medal, he regretted the subscriptions had not come in as well as the Council would have liked. The sum gathered had been principally contributed so far not by the ordinary members. He trusted the ordinary members would see their way to give it their earnest consideration. The amount received was £12; so that they were still £5 or £6 short of the sum necessary to place the thing on a proper basis.

New Members.

The President then read the names of a long list of new members who had been elected to the Association. It included Mr. J. D. Keillor, Manager at Ardrossan, and men from various departments of the gas industry. He welcomed such a large accession to their strength.

Gas-Governors.

The President thanked the members for the kind reception they had accorded him when Mr. Frazer introduced him. He never dreamed that he was to occupy the presidential chair this year, and the fact that he did so naturally followed on account of Mr. Cuthbert having gone to London. It was to be regretted that Mr. Cuthbert, after his services as a Committee man and Vice-President, was unable to put on the copestone by taking his place as President. However, he had gone to the Mecca of the gas profession—the great centre of the universe—and he was sure all agreed with him that their best wishes went with Mr. Cuthbert in his new sphere; and they trusted he would succeed there. In thinking over a possible Presidential Address, not anticipating anything this year, but looking forward to next year, he had observed, in looking through a great many Presidential Addresses all over the country, that nearly every point had been touched upon, with the exception of two which seemed to him to have been omitted—water heating by gas and the question of gas-governors. Gas governing and governor construction was going to be a very important item in the near future. Now that the day of high pressure was drawing near, it was going to bulk very large. He thought on the probability and practicability of giving a paper dealing with governors. But he asked himself: Why should he, a layman, do so, when he knew that his friend Mr. Carmichael Peebles would be glad and willing to give them a paper on the subject? The name of "Peebles" was a household word in the gas industry of the country. Away back between 1870 and 1880, Mr. Bruce Peebles delivered what still ranked as a classic in the transactions of the gas profession—a paper dealing with pressures and gas-governors. In asking Mr. Peebles to come among them, he considered they had done very good business. In giving this paper, Mr. Peebles was laying before them, not only his own experience, but that of his predecessors.

Mr. Peebles then delivered his paper, which will be found on p. 114.

At the close, the author was accorded an enthusiastic vote of thanks.

HIGH AND LOW PRESSURE DISTRIBUTION SCHEMES AT TYNEMOUTH.

By F. C. Willis, of North Shields.

[A Paper read before the North of England Gas Association, Oct. 7.]

In reopening for discussion the subject-matter contained in my paper read before the Association on May 6 last, I feel it is not desirable to encroach too much upon valuable time. There are, however, one or two points which are perhaps of interest, and also a few raised through the medium of the Technical Press. These, with your permission, I propose to touch upon as briefly as is possible.

Scheme A.—High-Pressure Distribution.

As intimated in the paper already before you, the tests relating to illuminating and calorific values detailed therein were not to be taken as representing ultimate results, having due regard to the comparatively small number of tests carried out prior to their publication. Since May last, we have continued, over an extended period, a series of tests relating to the effect of compression upon the initial quality of the gas. These tests have been conducted as carefully as possible; and while we regret it was not convenient to place before the members a more comprehensive result, our figures may be accepted as representing the average of a number of readings taken under normal working conditions.

In all cases the particular sample of gas, approximately 150,000 cubic feet in volume, was isolated during the whole period of the duplicate test. Readings were taken before compression at the works (A), and after compression at a specially erected station (B) in the new district recently added; this latter testing point being established about a mile from the No. 2 governor house and some 7½ miles from the works, measured on the pipe-line, and therefore well removed from the point of expansion. The meters, standard burners, lamps, &c., used during the tests were all standardized, thereby ensuring strictly comparative results.

Regarding the table of rates of delivery of gas under compression through the high-pressure main. As there appeared to be some slight difficulty in the interpretation of the table already given, I now tabulate some of the results, together with others obtained, in an amended and simplified form. It has been pointed out that certain apparent discrepancies appear in the tables. In reply, I can only state that these are given as recorded by instruments adjusted to one standard; and to attempt to modify the figures, which represent practical working results, to accord with theory, would be to render them valueless. Loss of head of pressure is, of course, not the only factor affecting deliveries; but the magnitude of initial pressure has an important influence over them.

Tests of Illuminating and Calorific Value.

Illuminating Values.			Calorific Values (Gross). Calories.		
A.	B.	Decrease.	A.	B.	Decrease.
Works.	Holywell.	Per Cent.	Works.	Holywell.	Per Cent.
14·70	14·32	2·6	140·19	135·91	3·06

Tables of Rates of Delivery of Gas through High-Pressure Main.

Pressures. Pounds per Square Inch.			Rate of Delivery. Cubic Feet per Hour.
A.	B.	C.	Actual Delivery A to C.
18·00	18·00	13·00	12,600
18·00	18·00	14·00	12,500
16·00	16·00	11·50	12,500
15·00	14·50	8·00	12,500
14·50	14·00	7·00	12,500
14·30	14·00	6·30	12,500
18·00	18·00	15·00	11,600
15·70	15·00	9·00	10,000
15 00	14·50	7·50	10,000
14·00	13·00	4·80	10,000
14·00	13·50	5·70	10,000
14·00	13·50	11·00	7,500

Length of main A to B = 1870 yards.
Diameter ,, A to B = 4 inches.
Length ,, B to C = 4000 yards.
Diameter ,, B to C = 3 inches.
Pressures in Column A were taken at the works compressor outlet.

My remarks would not be complete without some reference to the joints and jointing material used in connection with the high-pressure scheme A. It is necessary to correct certain misapprehensions which have arisen regarding the pressure tests. As stated previously, the main was tested in sections during the progress of the work by air pressures of 65 lbs. and 30 lbs. per square inch respectively. After completion, a gas test of 15 lbs. per square inch was applied; and while under this test, the pressure in the main dropped from 15 lbs. to 7 lbs. in 15 hours. It should here be pointed out that the cause of this drop in pressure was not found to be defective socket joints, but a defective syphon tube and plug, which, owing to the comparatively large leakage, were located soon afterwards and replaced. The subsequent tests carried out by us showed that there was no tendency whatever of the gauge to drop.

While again wishing it to be understood that my intention is not to condemn another excellent form of joint, the decision to use run-lead was the outcome of practical tests carried out at the works, considered along with general conditions. It has been said that it is impossible to make a sound and lasting joint with run-lead and the "rigid" type socket joint. Our experience is contrary to this; and the question of the durability of joints over an extended period applies equally as much to lead-wool as run-lead. Both are greatly dependent upon the workman's skill and care for their ultimate efficiency.

Tests carried out under careful supervision revealed practically no difference between run-lead and lead-wool, though there was found to be a marked improvement in those cases where the pipe coating was removed as compared with those in which the coating at the joints was allowed to remain. All the joints included under the tests were practically tight under the following pressures: Air, 70 lbs. per square inch; gas, 30 lbs. per square inch; water, 300 lbs. per square inch. All joints tested could be made to leak by the application of heavy shocks and vibration. The run-lead joint with coating removed proved itself to be a satisfactory one; and when carefully run and thoroughly caulked it is perfectly tight. It forms a united and homogeneous mass closely fitting the socket, and, in the case of the rigid joint when used without yarn, tapers gradually and enters about 1 inch into the back sleeve of the socket. As yet we have not observed any tendency for run-lead joints to draw outwards, due to vibrations or other disturbances while under pressure.

A series of small experiments recently carried out in connection with high-pressure lighting, while perhaps not of any very special value, may be of passing interest to those contemplating new lighting schemes. We have had one of the Keith type 1000-candle power inverted lamps connected to our high-pressure main at different points. The lamp is fitted with automatic lighter, and has a suitable diaphragm governor attached for reducing the gas from the higher pressure to about 54 inches water-gauge. This type of lamp has been found to light equally well at the works

with governor inlet pressures up to 30 lbs. per square inch or at a point 6½ miles away with an inlet pressure up to 10 lbs. With a satisfactory form of governor, we are of opinion that it is practicable in high-pressure lighting schemes to maintain high pressures in a trunk main of considerable length and reduce-down where required for groups of lamps.

In this way, it will be possible to obtain a considerable margin of delivery capacity with a comparatively small trunk main. A feature in connection with the low-pressure scheme B, described in the second part of my paper, may be mentioned here. Though the circumstances have no direct connection with the actual duty of the plant, they serve to indicate its utility. A few weeks ago, we were obliged to cut out, divert, and re-connect a portion of our 24-inch distributing main which is connected to the 18-inch trunk main referred to, and supplies (roughly) 8000 consumers. A temporary 8-inch bye-pass was connected up to the main beyond the limits of diversion, and by running the fans continually over a period of about eight hours, and maintaining an outlet pressure of 16 inches water-gauge, we were able to carry out the work, and successfully supply our consumers without a single complaint of any kind.

Discussion.

The PRESIDENT (Mr. Henry Tobey), in inviting discussion on the whole subject, said the paper afforded a good deal of information which might be of use to those who contemplated anything of a similar kind in their district. It struck him that the Tynemouth Gas Company must have had a large area allotted to them by their Act of Parliament to enable them to go so many miles away from their works. They were not so circumscribed in their area as many other gas companies were; otherwise they would be acting outside the powers of their Act. He did not see how his own Company, for instance, could enter a village and lay a system of high or any other pressure mains in the way referred to unless they were authorized by Act of Parliament. His own Company were limited to two miles from the centre of the town.

Mr. A. C. HOVEY (Sheffield) congratulated Mr. Willis on the paper he gave them at the last meeting and also on the supplementary paper now put before the members. He regarded the supplementary paper as being of exceeding value for several reasons. One was on account of the tables given in connection with the reduction of the illuminating power and the calorific power of the gas. In the paper, he believed, these reductions amounted to something like 7·6 per cent., which looked to him serious. But now they were down 2·6 to 3 per cent. he thought it was quite a reasonable reduction in any system of gas distribution. It was very surprising to him that, in view of the great developments which had taken place in America in connection with the high-power distribution of gas, in this country comparatively little had been done. He thought the Tynemouth was the only installation of its character in the territory covered by the Association. Particulars and figures were recently put before the profession by Messrs. Shelton and Searle in America which were clear and explicit as to the advantages to be derived from the high-pressure system; and the facilities were so great that it was surprising that far more had not been done in this country. The simple arrangement by means of which high and low pressure were used alternately should receive special attention as well as the extremely high carrying power of mains used on this system. Mr. Willis had mentioned that the initial pressure had a great deal to do with the carrying power of the mains. The Cox formula, he believed, was that the carrying power of the mains was according to the square root of the difference between the high initial pressure and the terminal pressure; so if the initial pressure became great, the terminal pressure became almost negligible in the calculation. If these pressures were increased to (say) 40 lbs. as the plant admitted, he thought it very nearly doubled the carrying power of the mains. The speed at which the gas went must have an important effect upon it; and he thought the drying effect upon the gas should compensate for the throwing-down of illuminants. He thoroughly agreed with Mr. Willis's remarks on the joints. He had made a number of experiments especially with respect to vibration, which proved that the ordinary soft lead joint, well driven home in the rigid type of socket, gave most reliable and most satisfactory results. The mere fact that this joint was adopted by the Tynemouth Gas Company showed that it was quite equal to any other type of lead joint to be found on the market.

Mr. W. A. WALKER (Wallsend) asked Mr. Willis if he had had any experience of gas from which naphthalene had not been removed, because there was a larger amount of naphthalene that went down when the tension was removed. In regard to the Tynemouth scheme, one must take into account not only the capital expenditure, but also the expense of running the plant. He himself, in building new works, considered the advisability of running a high-pressure main from the works known as the Walker works to about 3½ miles away; and from information that he obtained, he did not see much difference between a high-pressure pipe and the ordinary low pressure. He would like to ask if Mr. Willis could give them some idea of the running costs. He congratulated him on the way the joints were made in laying the mains. He believed a joint well yarned was half made. At the Paisley works, where he was indentured to Mr. Hislop, they made all their joints inside the works with Roman cement. On one occasion they had to lay a temporary main of about 600 to 700 yards long; and it was laid with ordinary cement. The joints remained intact for several months until they were replaced with Roman cement.

Mr. W. HARDIE (Tynemouth), referring to Mr. Tobey's remarks, said they had gone outside their scheduled area to carry some of the pipes Mr. Willis alluded to; but they had done it with the consent of the local authority, and he did not think they were likely to have any trouble. He thought, however, when they went to Parliament (as they had arranged to do very shortly), that they would get the powers they asked for. They had not so far had any trouble about it; but he should not recommend anybody to do the same thing.

The PRESIDENT: You just went and did it, and will get absolution afterwards. (Laughter.)

Mr. R. WOOD (Barnard Castle) said they had been following the example of Tynemouth, and were engaged in carrying a high-pressure 3-inch steel-pipe system from Barnard Castle to Cotherstone—a distance of four miles; and he wished to express, on behalf of his Company, their indebtedness to Mr. Willis for the valuable hints they had received from his paper.

Mr. J. E. MORFETT (Sunderland) said Mr. Willis had answered a certain question which arose out of his first paper in accounting for a difference between 15 lbs. and 7 lbs. pressure—a loss of 8 lbs. This was accounted for by the leakage of the syphon, which was apparently a satisfactory explanation. Speaking of the rigid type of joints he had used, he had recently been using these joints for laying a high-pressure main; and while doing so he took advantage of the opportunity of testing the joints with no lead wool in them at all—using only the spun yarn. He put on pressure without lead wool; and he found he got quite perfectly sound joints with the yarn by itself without any lead wool. He was very glad to find that the joint could be made this way, and he thought Mr. Wood was wise in adopting it.

Mr. J. P. M'CRAE (Great Northern Railway Gas-Works, Doncaster) said, in regard to the loss of pressure and the amount Mr. Willis gave them, he wished to know if he could say what results he got from further tests, and what figure he now considered a satisfactory leakage for the amount of the gas supplied under the particular pressure he employed.

Mr. WILLIS then replied to the discussion, assuring the members that it would be a pleasure to his chief, Mr. Hardie, or himself, to give any further information regarding the scheme he had described or show them the plant itself. He was interested in Mr. Hovey's remarks. He pointed out the question of illuminating and calorific values had been gone into further; and it was satisfactory to show that their further reductions were not so bad as they appeared at first. He could only say that the tests which he had named in his supplementary paper were the average taken over a large number of readings extending over some months; and they could adopt them with perfect confidence. The question of delivering gas through high-pressure mains was really an interesting one. There was no doubt there was a big margin of capacity in high-pressure mains as compared with low-pressure ones. Mr. Walker's remarks were also interesting. He took it that he understood that they removed naphthalene. With regard to the naphthalene deposits, he had no reason to suppose there was any trouble in this respect. With reference to the question of costs, he (Mr. Willis) quite agreed with Mr. Walker, as in the short distance involved in his case it might not be any advantage to fit up a high-pressure main for his particular purpose. The cost of compression in their particular case at Tynemouth, however, did not come out very high. They put the plant in the engine-room; and, as a matter of fact, they did not employ any extra hands to work the compressor. They had advanced the engine man's wages a little at the time. The question of extra charge came in the cost of lubrication. There was also the question of fuel. They were fortunate in having boilers with considerable margin of capacity, which made practically little or no difference—perhaps a little extra fuel. As near as he could tell, the total cost of compression ran out about £38 to £40 per annum, and when taken out on "at per 1000 cubic feet," it worked out on their present delivery at the small amount of 0·46d. Mr. Wood, he was pleased to see, was following the example of Tynemouth; and he could assure him that, where the distances were great, it was the correct thing to do. For a distance of three miles or upwards, it was certainly economical. He could say their experience had been in every way satisfactory; and they had never had the slightest trouble. Mr. Morfett spoke upon the question of leakage, and he (Mr. Willis) was interested to hear that he had had practically a tight joint with the rigid socket, which went to show that the joint itself was an excellent form of joint. Mr. M'Crae also raised the question of the leakage, and wanted to know what results were got at Tynemouth when the defective pipe was replaced. They tested the main every four hours after the pipes were replaced; and at the end of the four hours they were not able to see any apparent pressure on the mains. He could not conceive it possible that any main would be perfectly tight for an indefinite period. There must be some small leakage; and it was practically impossible to maintain a perfectly tight system if the main extended for some miles from the works.

Dessau Vertical Retorts for Auckland.—The Vertical Gas-Retort Syndicate, Limited, have received an order for three beds of eight retorts each (making 24 retorts in all) for the Devonport works of the Auckland (N.Z.) Gas Company.

GAS-GOVERNORS.

By W. Carmichael Peebles.

[A Paper read before the Scottish Junior Gas Association—Western District.]

Since the earliest days of gas lighting, the question of pressure has been ever before the gas engineer, as one of the most important of the problems with which he has had to deal—how much to give, and how to control it. Many of the difficulties that beset the engineer then are still with us, though now we have means of dealing with the pressure for practically every variety of service. Before the advent of incandescent lighting, or the production of power and cooking by gas, 5-10ths pressure was practically the only one required by consumers for their burners, which then were of the rat-tail or flat-flame type. Now we have a great variety of burners and gas apparatus in use, for which different pressures are required; making the task of distribution increasingly more difficult.

In these days of standardization, it is astonishing to find that standard pressures have not been more aimed at by gas managers. Looking over the pressures supplied by night and by day in Scottish towns, there are hardly two alike; and yet all are using apparatus adapted only for one definite pressure, from which the greatest efficiency and economy can be obtained. No doubt, by adjusting the tap or by using stuffed burners, adjustable nipples, and air-regulators, we can get an approximation to maximum efficiency at certain times when the pressure reaches that for which the adjustment has been made. But this is only a makeshift of the most crude description. In electricity supply a standard pressure must be maintained, otherwise there would be dim light if below, and burning-out of the filament in the lamp if above, the standard. Over the supply area pilot-wires indicate at the electric light station the pressure at distant points; and special feeders, fed by boosters, give an extra pressure when required. Because we happen to have a more flexible agent in gas, is no reason for misusing it; and it is now recognized that, for satisfactory and efficient results in gas supply, an unvarying pressure is essential.

In order to give a basis for discussion, I suggest that, with our present-day knowledge and requirements, for ordinary domestic consumption the standard pressure of gas supply throughout the country should be 2½ inches at all consumers' premises, to which pressure all our burners, stoves, fires, gas-engines, &c., should be adjusted. Instead of this condition of affairs, what do we have to deal with? From the last statistics regarding this question in Scotland, published by the North British Association of Gas Managers, in the report of their annual proceedings, I find one town with 54-10ths night pressure and 21-10ths day pressure; while another had 18-10ths night pressure and 10-10ths day pressure at the outlet of the station governor. One cannot say that these ranges of pressure would be obtained at all or even any of the consumers' premises; but it is of sufficient variation for us to presume that the consumers have great fluctuations of pressure in their premises, and that the burners, &c., suitable for the one town could not be suitable for the other. Yet probably they are the same. But, more than this, we find that in the same premises we have flat-flame burners, which at the point of ignition require 4-10ths to 5-10ths; incandescents, needing 15-10ths to 20-10ths; fires and cookers and gas-engines, 12-10ths to 20-10ths—all supplied from the same service. How can we possibly get perfection under such circumstances?

I join issue with those who, while admitting that governors are necessary for flat-flame burners, say that for incandescent lighting or gas-fires they are a matter of less importance. They agree that more gas is consumed with extra pressure, but state that the larger consumption is all accounted for by increased light or heat. I will show later by experiment that this is not always the case. The "bunsen" principle, used with practically all forms of gas-burners for heating and incandescent lighting, requires that a definite quantity of air must be mixed with a certain quantity of gas to give the hottest possible flame. Vary the quality of the gas, and more or less air is required; alter the pressure, and, again, more or less air is required. The candle power and heating value of gas vary in nearly all towns. Consequently, a different amount of air is necessary in each case for the same burner. Add to this the varying pressure and the innumerable types of burners in use, some giving the best result with one quantity of gas and pressure, and some at another, and you will realize that we have a very imperfect method of consuming our gas. By fixing the pressure, we eliminate two of the most important factors at present varying—viz., the quantity of gas consumed, and the amount of air drawn in. The air-regulator would then only be necessary to deal with the fixed quantity of air required by any particular quality of gas.

Owing to the difficulties met with in distribution, there is only one effective way of securing for the most distant consumer a uniform pressure—by surcharging the mains and governing all consumers' premises. This may seem an ideal, and at first sight an impractical, suggestion; but it is now receiving the attention of many gas companies and corporations, who are either fitting up governors free at every service, or else hiring them out for this purpose.

No doubt there is a great deal being done by gas engineers and managers at the present moment outwith the consumers' premises, to bring about that most desirable condition of a uniform pressure to all consumers at all times of the day and night; and before going into the question of governors for consumers, I will run over shortly the different kinds of governors in use at the gas-works, and for distribution purposes.

Retort-House Governors.

Curiously enough, we start first with one of the most recent types of governors devised for controlling the gas as it leaves the retort. The object of the retort-house governor is to maintain a steady draw on the retorts, irrespective of the volume of gas being made, or the pull of the exhauster, either due to variation of speed or the increased or diminished quantity of gas it has had at any time to deal with. When the retort is first charged, gas is given off the coal in large quantities, which gradually diminish until the coal is exhausted. Should the make or the speed of the exhauster decrease, the governor-valve opens to allow more gas away; and, on the other hand, as the make diminishes, or as the exhauster speed increases, it closes down to prevent the draw affecting the amount of suction in the main. Thus the gas leaves the coal quietly, and always moves in one direction, which maintains a uniform quality during the whole process of carbonization.

There are four forces at work inside the retort-governor: (1) The pull of the exhauster; (2) the "make" of gas; (3) the lifting power of the float fixed to the governor-bell, or the effect of the counterbalance, which balances; and (4) the weight of the bell and valve. These forces have to be so balanced when the governor is in action that the result will be a vacuum, usually about 1-10th to 2-10ths of an inch in the hydraulic main.

The gas rises from the retorts by the ascension-pipes, and passes down the dip-pipes to the hydraulic main, where the water or liquor seal is met. This seal is drawn aside by the suction of the exhauster, and the gas passes away through the governor. Without the governor, the seal cannot with safety be reduced to 1-10th or 2-10ths. Pressure then gathers, and the gas is churned about in the hot retort, altering both its character and quality. The deposition of carbon in the retorts, which is usually found when the seal at the dips is heavy, is always, if not entirely, absent when the retort-governor is put in. The benefits of the retort-governor may be summed up in the words, safety, uniformity, quality, and economy.

Station Governors.

We now pass to the station governor, which is the chief controlling governor of the gas supply from practically all gas-works. The station governor dates back to 1815, when Clegg invented a governor which in principle is similar to those of the present day, though varying from them in design.

The ordinary form of station governor consists of a valve-case and a bell-tank made in cast iron. In the tank, an inverted bell is placed, sealed by water to contain the gas; and suspended by a rod from the crown of the bell is a single or double valve, moving in the valve-case, which is fixed below the tank. The weight of the bell and valve may be carried either by a float attached to the side of the bell, or by a counterbalance beam, from one end of which the bell and valve are suspended, while to the other end weights are attached. The form of the valve or valves is of great importance in order to obtain a gradual opening and closing, and to prevent oscillation. This is secured by making either a cylindrical seating with tapered perforations, in which the valve moves, or a plain seating with a hollow cylindrical valve in which the perforations are placed. The parabolic form of valve also gives the desired gradual opening and closing; while in another type, the valves may be made to partially shut off the one in advance of the other. The inlet or varying pressure is equilibrated or balanced by acting upon the two valves of equal area, or, in the case of only one valve, between it and a balancing bell of equal area, thus destroying, or entirely counteracting, the effect of the inlet pressure upon the moving parts. The outlet pressure, which we desire to remain uniform or constant at whatever it may be set, acting on the under-side of the main bell, raises it and closes the valve, should the pressure tend to rise; or falls, opening the valve, should the pressure tend to decrease. By opening or closing the valve according to the demand for gas from the mains, more or less gas is admitted to them, thus keeping the pressure constant.

The loading of the governor to alter the pressure may be done in one of several ways, to suit individual requirements and ideas. It may be effected by solid weights, by the weight of water, or by means of air pressure or the gas pressure from a distance. Weights of definite size commend themselves to many, as the man in charge is simply told to put on or take off so many weights at stated times. These may be quite small, so that the pressure is altered gradually. He has no need even to refer to his pressure-gauge, though this is always a good thing to do with any system. With water, a very gradual loading may be obtained by running water at a certain rate into a chamber fixed to the top of the bell, and having an adjustable overflow, so that only a certain quantity will remain loading the bell. To unload, the process must be reversed—closing the tap on the pipe leading the water to the governor, and opening a tap to a syphon or draw-off pipe, to gradually allow the water to run off. For air-loading, a small bell inverted in a tank of water is loaded with weights, instead of the governor-bell. The compressed air is conducted by a pipe from under the air-bell to the governor-bell chamber, thus loading the governor-bell. With gas-loading, the inlet pressure is carried by a pipe through a small independent pressure-governor to the

main governor-bell chamber. The auxiliary governor is loaded by weights, to give a certain pressure, which acts on the main governor-bell in the same way as the air pressure. The latter system requires that a small pipe be connected from the governor-bell chamber to the governor outlet, or a jet kept burning on the outlet of the auxiliary governor, so as to get rid of any accession of pressure due to the main governor-bell rising. Automatic loading has been introduced so that, as the flow of gas increases, so does the pressure. It has been carried out by means of the weight of a quantity of water or mercury flowing from a separate small vessel on to the governor-bell, due to the opening of the valve to pass more gas, and the consequent lowering of the level of the tank on the governor-bell; and *vice versâ* for unloading. It has also been carried out electrically and by clockwork, both locally and from a distance. As a rule, however, for works of any size, there is a man in attendance, who looks after the station governors.

In the designs of station governors shown, you will observe that all are of the enclosed type. Thus absolute safety is assured, as the bell cannot be tilted out of position. I have now described some of the various types of station governors; and we see that the gas manager can send his gas out at any desired pressure, limited only by the pressure from his holders. As I have said, however, his control of the pressure does not end here—which brings us to the question of district governors.

District Governors.

Coal gas being lighter than air, it tends to rise; and we find that there is an actual increase of 1-10th pressure for every 10 feet of elevation. It consequently requires pressure to send gas downhill; and for this reason gas-works are usually placed at the lowest point in a town, where a suitable site can be obtained. Wherever we have a hilly district, then we have this variation of pressure, due to the difference of elevation. Thus at 50 feet above the gas-works, there will be an accession of pressure of 5-10ths; while at 200 feet, the increase would be 2 inches. Therefore hilly districts usually get too much gas, and low-lying areas too little; and to give sufficient for the latter makes the condition of the supply to the former all the worse. The governor to deal with such circumstances is the differential district governor. This governor will reduce the pressure to any desired amount, and will give a uniform outlet pressure, with varying delivery, so long as the inlet pressure remains constant. As the pressure at the station governor is altered at certain hours, so the differential district governor will automatically alter the pressure to its district, always maintaining the difference of pressure to which it has been set.

The valve in the differential district governor shown consists of a light cylindrical valve with tapered perforations in the side, so as to give a gradual cut-off. It is closed on the top, on the under-surface of which the gas pressure acts to keep the valve open. Weights are placed on the valve-spindle in a small chamber cast on top of the valve-case. According to the number of weights, so more or less pressure is required to actuate the valve. But there is always the difference of pressure between the outlet and inlet, due to the weight of the valve and loading weights.

In most large towns with many miles of mains, some of which have become too small, the difficulty of supplying a uniform pressure is often very great. Thus a district with good sized mains may be having an adequate supply; while one with small mains, and (as usually happens) a large demand, has too little. In order to make the one right, except at the great expense of new mains, interferes with the supply to the other. It may, however, be assisted by the division of the network of pipes into districts, and placing district governors at certain points on the trunk main to feed these districts. The type of governor used in this case is one which will give a uniform outlet pressure, similar to the station governor. This allows a good pressure to be maintained in the trunk mains, so that there is sufficient gas for either a low-lying district or a district with a large consumption, or under-sized mains. The governor is usually placed in the street underground; and the best means of loading it, if the pressure is to be varied during the day, is by means of air pressure from a distance, either by placing the air loading-vessel in a cellar or in an iron pillar box on the side of the pavement. A governor for underground must be very compact; for, as a rule, there is not more than from 2 ft. 6 in. to 3 ft. from the main pipe to the surface of the street, so that a station governor is not suitable. The governors shown are specially constructed with this aim in view.

The first shows a governor with a bell (from which double valves are suspended in the usual way), working in a mercury seal. Mercury is used because of its density, as a very small depth of seal is sufficient for a heavy pressure of gas; mercury being about 13½ times as heavy as water. The inlet pressure is balanced between the two valves. Consequently, the latter are always in equilibrium. The outlet pressure, acting on the under-side of the bell, raises or lowers the bell and valves, according to whether the pressure tends to rise or fall—thus allowing more or less gas to pass. The loading may be effected by weights placed on the valve-spindle above the bell; or air pressure from a small holder at a distance may be brought to act on the top of the bell—the small holder being loaded by weights instead of the governor-bell, thus avoiding interference with the street traffic. The other type of underground district governor is one where a water-seal is used; but in order to get sufficient depth, the bell is placed under the valves, instead of, as in the usual station governor, above the valves. Again, loading may be carried out either by weights placed on the spindle of the governor-valves, or by means of air pressure from a distance acting under the bell, and reducing the pressure. It will be noticed that the weight of the bell and valves is carried by a float fixed to a bell, and that the valves are full open when the bell is in its highest position. The outlet pressure acts on the top of the bell, forces it down, and closes the valves, should the pressure increase; or should the pressure tend to fall, the float will raise it and open the valves, thus passing more gas and maintaining the pressure.

Consumers' Governors.

The dividing of our area of supply into districts, and the using of suitable governors, will largely help towards our ideal conditions of uniform pressure at all hours for consumers' premises. But in most towns we have unfortunately to face the fact that there are many overloaded services, and that consumers' premises are not always ideally piped for a proper supply. Certain premises may be receiving adequate, or even a too great, pressure at one time of the day; while at another, owing to the use of gas in adjoining premises, the supply may be so affected that a reasonable light cannot be obtained. It is the variation of pressure that is so irritating, and causes the waste of gas and loss of light. In domestic lighting particularly, you will often find, as the pressure increases at night, people turning down the tap to stop the noise and glare of the lights in their sitting-rooms. They can see by the brightness of the light the result of their action; but if the mantle were removed, they would probably find a soft blue flame, the heat value of which could have been produced by a much smaller quantity of gas properly consumed. We can easily get fittings adjusted for either a high or a low pressure, and nothing more would be needed, provided the pressure remained uniform; but this is what we seldom, if ever, get, even in the best distribution areas.

I am afraid that, as stated before, there is only one way in which this object can be attained—viz., by the use of governors for every consumer. The great difficulty is the question of the initial expense, though this would be more than repaid by the economy and greater efficiency resulting; and yet I believe the time will come when all gas authorities will be empowered by Act of Parliament to take the control of the supply right up to the consumers' burners, charging a small sum for doing so, which will cover the expense of the necessary appliances to use gas in the most scientific way.

For premises which are properly piped, and where one class of burner only is in use, a pressure governor at the meter may be sufficient to control the whole supply effectively. These governors act like the station governor, giving a uniform pressure whether one or more burners are in use or not. In the smaller governors, the valve is suspended from a bell and sealed in mercury, or from a diaphragm of leather or other suitable material. The outlet pressure, which is the pressure we desire to remain constant, acting under the bell or diaphragm, raises or lowers the valves, thus enlarging or diminishing the gas supply. By placing on or taking off weights, the outlet pressure is increased or diminished to suit the requirements of the premises and the conditions of the supply. Where there are many floors in a building, one governor at the meter may not be entirely effective, owing to the increase of pressure due to elevation. A small governor on each floor would no doubt be preferable in such cases. Or, again, there may be different kinds of apparatus, each constructed for different pressures.

This brings me, then, to the governor at the point of ignition. Such governors are used in street lighting, railway stations, gas-works lamps, and other widely distributed lighting points. They are also largely employed for domestic lighting and heating, especially with incandescent and flat-flame burners and gas-fires. For individual lighting points (except in some instances where the pressure governor is best), small volumetric governors are used. These governors may measure a definite quantity or volume of gas to the burners, irrespective of any variation of the pressure. They are made in a form suitable for flat flames, upright and inverted burners, large lamps, and for gas fires and stoves. They are instruments of precision, and, if occasionally cleaned, may be taken as a ready method of measurement of the gas, by merely multiplying the number of governors in use by the number of lighting hours, and the product by the quantity of gas the governors are set to pass per hour.

The principle underlying the action of the volumetric governor is that the disc or float (as it is sometimes called), moving without friction in a cylindrical chamber, floats between two gas pressures. When the gas is first admitted, the disc rises momentarily to its highest point, closing the valve until the gas passing through side-holes in the disc enters the chamber above the disc, which is then between two equal pressures. The weight of the disc then causes it to fall, but only until the weight of the disc, *plus* the pressure above it—now reduced owing to the gas passing to the burner—equals the initial pressure. The difference of pressure below and above the disc continues under all changes of initial pressure; and the pressure of the burner is kept constant, varying only when the aperture or nipple of the burner is varied. But the quantity of gas remains uniform under all pressures. The disc rises and falls as the inlet pressure varies, thus opening and closing the outlet of the tube on the disc through which the supply to the burner is conveyed.

In individual lighting points, where there are more burners than one, and a variable quantity of gas is required, as in duplex fires,

cookers, cluster lamps, &c., where one or two burners may be extinguished at certain hours, the volumetric governor is unsuitable except for the maximum supply. Small pressure governors should be used in such cases, which will regulate the pressure whether one or more burners are in use, and whether the tap is full on or turned down.

Gas-engine supplies should be controlled by specially constructed pressure governors, so that the suction of the engine drawing gas is not too quickly transmitted to the regulating bell or diaphragm of the governor. The losses occurring in the gas-engine due to the irregular charges is very great. At a certain speed a definite amount of gas and air is drawn into the cylinder. If the gas pressure varies, the best mixture is not obtained to give the highest efficiency and economy—too much gas giving a slow burning charge, forming soot and carbon, which spoils lubrication and chokes the valves; and too little gas causing a weak explosion, mis-fires and back-firing, due to a weak mixture, and wire-drawing with loss of compression, as the cylinder is not fully charged.

The governors described cover all the requirements necessary to obtain for our consumers a practically uniform pressure of gas for all kinds of apparatus suitable for domestic gas consumption. I do not intend to-night to touch on what is termed high pressure, but would observe that the term is apt to be misleading. We should always, in dealing with gas consumption, mention the pressure at which it is taking or is to take place. Thus, when you want a 3-feet burner, always state the pressure that will be available. With the varying pressures we have, it is recognized that this is somewhat difficult. The adoption of a standard pressure for the whole country would mark a great advance in the progress towards efficiency in the proper combustion of coal gas. Enormous sums of money have been expended in improved means for producing the gas; and it seems a pity that the valuable product thus obtained should be wasted for want of proper attention by consumers in their methods of using it.

[The paper was illustrated by a large number of limelight views and experiments.]

THE INTERNATIONAL OUTLOOK IN SCIENTIFIC ILLUMINATION.

Last month an International Congress of Applied Electricity was held in Turin; and among the English delegates attending it was Mr. Leon Gaster, who publishes in the "Illuminating Engineer" for October an abstract of the paper he read.

In the course of it, he pointed out that it is very important that common and accepted methods of comparing the merits of different systems of lighting—not only as regards cost, but also from the standpoint of intensity, distribution of light, colour, hygienic effect, &c.—should be adopted in different countries. There are also many practical problems—such as the best methods of measuring illumination, the amount of light required for various industrial purposes, &c.—on which international agreement would be very valuable.

As an illustration, the statement that this or the other illuminant approaches nearest to daylight in colour, needs examination. Convenient and scientific methods of testing this point are needed. The value of securing artificial illumination almost identical with daylight, for colour-matching, is now appreciated, and a number of efforts have been made (by the combination of various lamps and by the use of specially designed screens) to change the colour of the light from both arc lamps and metallic filament lamps so as to comply with this requirement. Naturally this may involve a loss in the actual luminous efficiency; but this is often more than compensated for in correct colour revelation.

Another aspect of lighting that has been prominently before the public notice is the lighting of workshops and factories. At the second Congrès International des Maladies Professionnelles held in Brussels (under the patronage of the Belgian Government) last year, a number of important papers were read, dealing with the lighting of workshops and factories. In summing up the conclusions of the meeting, the Congress laid special stress on the need for the adequate illumination of dangerous machinery. Poor illumination was recognized as a frequent cause of accidents. This same view has been taken by the Departmental Committee on Accidents in Factories and Workshops (appointed in Great Britain), which has just issued its report. After instancing many cases in which imperfect illumination has led to fatalities and casualties, the report concluded by recommending that, "inspectors should be given statutory powers to require adequate lighting in all places where work is done and in all places which are a source of danger by reason of insufficient lighting."

It may be added that the Home Office in Great Britain have, in their recent reports, made the lighting of workshops the subject of special comment. What is, however, one of the most important steps yet taken in this direction is that just decided upon by the French Government which has appointed a Committee (of prominent oculists, gas and electrical engineers, inspectors of factories, &c.) to study the industrial requirements in illumination, and endeavour to agree upon an adequate standard of lighting for different purposes. It will also study the best methods of measuring light and illumination, and the effects of poor lighting in leading to defects of vision, and the hygienic aspects of lighting generally.

Another matter which has been the subject of much discussion in various countries is street lighting. Great Britain and the United States have both recently sent deputations to the Continent to study the methods in use; and in England a Joint Committee receiving support by members of the Institutions of Gas and Electrical Engineers, the Illuminating Engineering Society, and the Association of Municipal and County Engineers, is at the present time considering the drafting of a standard specification on street lighting.

All these are examples of efforts towards putting illumination on a more scientific basis. The work in this direction is largely the result of improvements recently made in methods of measuring illumination. We have now a variety of instruments adapted for this purpose; and although it may be expected that yet greater progress will be made shortly, the measurement of illumination may now be said to have reached a thoroughly practicable stage. It would, however, be desirable at this point to have a clearly laid-down basis as to the best method of making such measurements, so that, in the present attempts in different countries to collect data on lighting, the same methods will be pursued by different investigators, and results obtained which will be comparable one with another.

Another movement in the same direction, which has received very influential support, is the National Association for the Conservation of Vision recently formed in the United States. Experiments will be conducted with the object of studying defects in vision, and their relation with the conditions of illumination provided. A feature of the researches is the co-operation of medical authorities and oculists with photometric experts, lighting engineers, and representatives of great industrial associations interested in the welfare of employees.

For the same reason it is also desirable that common units, symbols, and definitions should be employed as far as possible. A great step has recently been taken in the agreement upon a common unit between England, France, and the United States. This unit is connected with that based on the Hefner lamp, and used in Germany, Switzerland, and Austria-Hungary, by a simple relation: 1 Hefner candle = 0·9 International candle.

But besides agreement on this point, it is also essential that some complete understanding should be arrived at as to methods of testing and expressing candle power. In some cases mean spherical candle power is determined; in others, mean hemispherical candle power; and in others, merely the light in some specified direction. The lack of some common practice in this respect has often proved inconvenient when comparing electrical illuminants of different kinds; and Professor Strache has pointed out that similar uncertainty is apt to be met with in the case of gas-lamps, especially in comparing lamps carrying upright mantles with those of the inverted type. Another point that should be made clear is the part played by reflectors in increasing the light in certain directions. Naturally the lower mean hemispherical candle power, for example, may be altered considerably by the reflecting powers of such accessories. If in some cases lamps are tested with globes and reflectors in position, and in other instances without such apparatus, much uncertainty is apt to occur in drawing any comparison between them. It may also be recommended that, whenever possible, the polar curve of light distribution of the lamps should be determined.

In any case, whatever method of testing is employed, authorities are agreed that it should be clearly stated whether mean spherical, or hemispherical, or candle power in some specified direction, is intended. It has become customary among many authorities to denote this by means of an appropriate prefix attached to the symbol—for example:

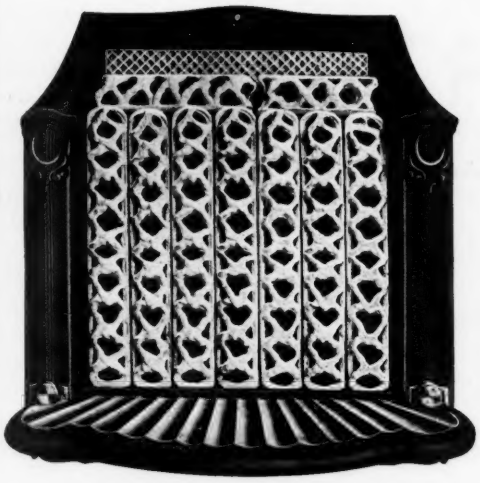
I_o denotes "mean spherical candle power."
$I_{\underline{D}}$ " "mean lower hemispherical candle power."
$I_{\overline{D}}$ " "mean upper hemispherical candle power."
I_h " "mean horizontal candle power."

A list of such symbols received the approval of the International Photometric Commission in 1907, and has also been accepted in Germany; but they do not seem to be yet sufficiently known and widely used in all countries.

There is also much room for improvement in simplifying the large number of units of illumination used in different countries, and in clearing up the confusion attaching to many terms which are used in distinct senses by different writers.

Dr. Monasch has tabulated the series of units of illumination commonly used; and, although a considerable simplification has been introduced by the agreement to use a common unit of light on the part of France, Great Britain, and the United States, the list is still a very long and varied one.

The question of nomenclature and symbols is a matter of consequence. Excellent work has been done in this direction by the International Photometric Commission, which has just concluded its third meeting at Zürich. It is satisfactory to note that the Commission is amending its constitution, so as to be more truly international and representative of the various illuminants concerned; and it may be suggested that this body, with the co-operation of the Illuminating Engineering Societies, might well become the centre of a permanent international committee to deal not only with photometry, but also with other problems of general interest in illumination.



"REGISTER-II."
Ready for fitting into Stove Grates.

ANOTHER "WILSON" ADVANCEMENT

THE "REGISTER-II." GAS FIRES

(To fit 12-in., 14-in., and 16-in. Grate Openings.)

SEASON 1911-12.

APPROPRIATELY, our new design **"REGISTER-II."** marks a great forward step in the type of Fire introduced by us for fitting into existing Stove Grates. This new pattern supplied in three sizes for filling 12-in., 14-in., and 16-in. grates is wonderfully **EFFECTIVE & ATTRACTIVE** and will create a big demand for these Gas Fires in place of using coal.

"REGISTER-II." fitted in Stove Grate, with Mantel.

NOTE.—Adjustable Stand supplied to fit under grate for filling space as a fender below.

"REGISTER-II." FIRES

ARE FITTED WITH OUR

NEW PATENTED FUEL,

IMPROVED FIREBRICK,

ENAMELLED

REFLECTOR, &c.

All
Sample Stoves
and Descriptive Leaflets
obtainable at once from

WILSONS & MATHIESONS, LTD.
LEEDS: Carlton Works, Armley.
LONDON: 76, Queen St., Cheapside, E.C.

ALL PARTS INTERCHANGEABLE AND REPLACEMENTS MADE FROM FRONT WHILST STOVE FIXED IN FIREPLACE.

DESSAU VERTICALS.

Adopted all over the World.

Total Carbonizing Capacity over 81 million cubic feet per diem.

Total Installations to date - 86.

FOR FULL LIST OF INSTALLATIONS, SEE INSTITUTION NUMBER OF "JOURNAL."

THE VERTICAL GAS RETORT SYNDICATE, LTD.,

17, Victoria Street, Westminster, S.W.

Absolutely Wind and Dust Proof.

THE

LUCAS LIGHT.

NO HIGH PRESSURE REQUIRED.

OUTDOOR.

The Lucas Light was the first and original self-intensive high-power lamp, and **its steady sale to-day proves its value.**

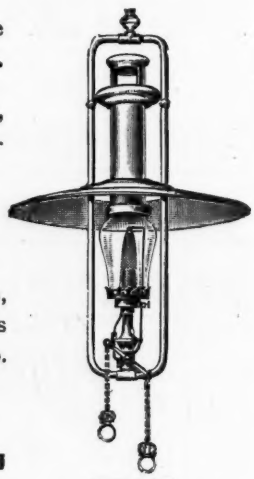
200, 400 and 700 candle-power from a single mantle, with gas at its usual pressure, and with the lowest consumption on record.

SIMPLE. BRILLIANT. RELIABLE.

The "Lucas" is the best lamp for Public Halls, Factories, Workshops, Streets, Railway Stations, &c., and the prices compare favourably with those of any similar type of lamp.

MOFFAT'S LTD.,

13, FARRINGDON ROAD, LONDON, E.C.



INDOOR.

THE FUNCTION OF TAR IN THE CONDENSATION OF COAL GAS.

By Alfred H. White and P. S. Tour.

[A Paper prepared for the Michigan (U.S.A.) Gas Association.*]

The traditional method of condensing coal gas is to cool it slowly and gradually during the later stages—allowing what tar and liquor will to separate in the condensers, and removing the remainder by frictional tar separators or scrubbers of one sort or another. In this process the minute particles of tar-fog grow by accretion during cooling, or by collision with one another, until they become large enough to be readily removed by mechanical means. The plan is undoubtedly the simplest which a young industry could devise; and its long retention proves its practical success.

At the temperature of 300° to 400° Fahr., prevailing at the top of the standpipe only, the least volatile portions of the tar are in the liquid form, and all the water is in the form of steam. The gases cool rapidly; and within a few seconds after they leave the retort (especially where they bubble through the water of a hydraulic main), they are reduced well below 200° Fahr., and much of the water has separated in the form of mist. It has required perhaps eight seconds to make this drop from the 1400° Fahr. temperature of the gas in the retort to the 200° temperature of the hydraulic main. The remaining 100° drop to the tar-separator is made gently and cautiously in one or two minutes. Why is it necessary or desirable that this last cooling should be so slow? Is it to enable the gas to get into equilibrium with the suspended tar at the lower temperature? Does it attain such equilibrium, and is it advantageous that it should?

The Condensation Process.

Ideal condensation requires the complete removal from the gas of all suspended particles, but the retention by the gas of all the valuable constituents which it can retain as vapours in the distributing system. This broad statement can, in practice, be narrowed to the usually accepted one that all the tar, naphthalene, and ammoniacal liquor must be removed, but that as large a proportion as possible of benzol should be retained.

In papers presented to your Association several years ago, as the result of investigations made by the holders of your fellowships, it was shown that the elimination of naphthalene was effected largely by the tar which, under proper temperature conditions and with sufficient time of contact, was capable of dissolving practically all the naphthalene. This statement was vigorously controverted by some authorities at the time; but it is, we believe, very generally accepted now. Since the elimination of naphthalene (which is desired) is effected mainly by the tar, and the elimination of benzol (which is deplored) is effected mainly by the same material, the discussion of the condensing process must centre largely in the relation of tar to these constituents under the conditions prevailing in the condensing system.

Tar is in part a mixture and in part a solution of many complex substances; but it will be sufficient for our present purpose to consider it as composed of non-volatile tar, naphthalene, and benzol—these substances being representative of the classes which are important in this connection. The non-volatile tar, although composed of many complex materials, behaves substantially as a single substance, liquid, non-volatile, and capable of dissolving naphthalene and benzol. The ammoniacal liquor requires only slight mention, as it does not materially change the equilibrium existing between the tar and the gases. It may, by coating the tar globules, check the rate of reaction between the tar-fog and the vapours, and so require a longer time of contact for the attainment of equilibrium between the gas and the tar.

It is worth while to carefully consider the consequences which would necessarily result if, on the one hand, equilibrium were attained and, on the other hand, if it were not attained.

Equilibrium between Gas and Tar.

If the removal of naphthalene and benzol were simply due to cooling, the gas would arrive at the tar-separator saturated with naphthalene but not saturated with benzol; for there is not a sufficient amount of the latter. Since, however, the condensed, non-volatile tar is capable of dissolving both benzol and naphthalene, if sufficient time has been allowed, there will be a definite equilibrium between the amount of benzol and naphthalene dissolved in the air and remaining in the gas. The gas, after the tar is separated, will not be saturated either with naphthalene or benzol.

If the tar had come to equilibrium with the gas before the tar was separated, neither the gas nor the tar should change if again brought into contact with one another at the temperature of equilibrium. It should, therefore, be experimentally possible to determine whether or not equilibrium had been attained by bubbling purified gas through tar at various temperatures. If equilibrium had been attained, a temperature should be found at which the gas and tar should be absolutely unchanged.

If this equilibrium point should be found, and then the gas and tar should be brought to equilibrium at a higher temperature, some of the lighter constituents of the tar—such as benzol and naphthalene—would be vaporized and pass into the gas. In again cooling the gas out of contact with the tar, there would probably be sufficient light oil to keep the naphthalene in liquid form; and possibly part of the benzol would remain with the gas and enrich it. There might, therefore, be a possibility of enriching the gas by scrubbing it with its own tar at the proper temperature.

If equilibrium had not been attained in the condensers, the result of tar scrubbing could not be foretold, except to this extent: If the gas coming to the separator was, for instance, only 50 per cent. saturated with naphthalene, and still equilibrium had not been reached, there would be still less naphthalene in the gas. Therefore, there should not be naphthalene trouble in any case if the gas and tar were brought together again at the temperature of the tar-separator.

If tar scrubbing were successful, it should be possible to cool the gas at any rate, and in any way desired mechanically remove the tar in a separator, then scrub the gas again with its own tar—removing completely even the finest particles of tar-fog and possibly improving the gas.

Experiments with Tar as a Scrubbing Agent.

The general method of experimenting was to place a known weight of tar in a series of bottles in a water or air bath. Purified coal gas was passed through a meter, bubbled through the tar at the desired temperature, and passed through glass condensers to a gasholder, from which it was subsequently taken for test. A plug of glass wool at the cool end of the condenser served as a support on which crystallized naphthalene or oily deposits separated. Successive portions of gas were passed through the same tar and tested until it was evident that equilibrium was being attained.

Table I.—*Results of Scrubbing Gas with Tar.*

[Each letter denotes a new sample of tar: A, B, and C, mixed tar from one charge of Pittsburg coal. D, E, hydraulic main tar from Ann Arbor Gas-Works. F, G, separator tar from Ann Arbor Gas-Works. H, drip tar collected between tar separator and final scrubber, Ann Arbor Gas-Works. J, mixed tar from one charge of same coal as A, B, C.]

Test No.	Tar Used.	Gas Used.	Temp. of Scrubbing.	B.Th.U. in Gas.			Candle Power.		
	Grms.	C. Ft.	Deg. F.	Before.	After.	Change.	Before.	After.	Change.
A1	100	6·0	167	625	583	−42	16·6	13·3	−3·3
2	,,	7·0	167	621	582	−39	16·3	16·1	−0·2
3	,,	6·0	167	619	606	−13	16·3	16·2	−0·1
4	,,	6·0	167	611	615	+ 4	16·8	16·6	−0·2
B1	100	6·0	148	621	595	−26	16·3	16·0	−0·3
2	,,	5·0	215	621	597	−24	16·7	16·0	−0·7
C1	100	3·0	216	623	610	−13	17·1	17·0	−0·1
2	,,	4·0	208	623	612	−11	17·1	16·4	−0·7
3	,,	4·0	212	623	614	− 9	17·1	16·4	−0·7
4	,,	5·0	215	623	617	− 6	17·1	16·2	−0·9
D1	125	6·3	212	592	572	−20	..	..	..
2	,,	4·5	,,	590	lost	?	..	..	..
3	,,	7·2	,,	607	614	+ 7	..	..	..
4	,,	5·6	,,	595	602	+ 7	..	..	..
5	,,	4·8	,,	597	594	− 3	..	..	..
6	,,	5·0	,,	606	602	− 4	..	..	..
7	,,	4·0	,,	603	lost	?	..	..	..
8	,,	4·1	,,	601	600	− 1	..	..	..
9	,,	5·0	,,	604	601	− 3	..	..	..
E1	130	1·9	212	606	564	−42	..	..	..
2	,,	3·1	,,	623	578	−45	..	..	..
3	,,	4·0	,,	631	624	− 7	..	..	..
4	,,	5·2	,,	644	651	+ 7	..	..	..
5	,,	5·1	,,	695	613	− 2	..	..	..
F1	75	5·1	212	602	580	−22	..	..	..
2	,,	5·8	,,	603	593	−10	..	..	..
G1	105	5·2	212	614	600	−14	..	..	..
2	,,	5·3	,,	614	612	− 2	..	..	..
H1	130	5·7	88	618	596	−22	..	..	..
2	,,	6·2	,,	618	608	−10	..	..	..
J1	110	5·1	300	599	620	+21	..	..	..
2	,,	5·2	,,	599	599	0	..	..	..
3	,,	5·0	,,	602	608	+ 6	..	..	..

Tests A, B, C [Table I.] form one series of tests divisible into three parts. The tar in this case was from a charge of 400 lbs. of Pittsburgh coal, distilled in the experimental plant at moderate heat. It was an average sample of all of the tar produced. Test A was made by passing successive portions of gas through the same sample of tar at 167° Fahr. It will be seen that treatment with the tar impoverished the gas in every case; the greatest drop of 42 B.Th.U. and 3·3 candles being with the first tank of gas. The impoverishment became less with each succeeding tank, until finally the fourth tank showed practically no change. In fact, the heat value showed a slight gain, which, however, is probably to be attributed to experimental error. The average result for 20 cubic feet of gas (the approximate amount produced with 100 grammes of tar) was a decrease of 31·1 B.Th.U. and 1·1 candles per cubic foot. The gas was evidently not in equilibrium with the tar at that temperature, and was made poorer by being brought into

* Mr. Tour is holder of the Michigan Gas Association "Fellowship in Gas Engineering" for term 1910-11.

equilibrium at the high temperature and then cooled to its initial temperature.

Tests B and C on new samples of the same tar at 212° Fahr. gave a similar result, although neither the illuminating nor heat values were so seriously impaired.

Test J, on a similar tar at 300° Fahr., showed a slight gain in the heat value of the first portion of gas treated, and practically no change in the subsequent samples. Only slight traces of naphthalene were deposited. The gas shows a slight improvement after this treatment; but it is believed that had it been cooled after scrubbing as low as it would normally be in winter, the slight gain would have disappeared. These tests had been made on an average sample of the whole tar.

Experiments were now made on hydraulic main tar (Tests D and E) and on separator tar (Tests F and G). In each case the tests were made with the tar at the temperature of boiling water; and, as in the previous case, the result is an impoverishment of the gas. No naphthalene separated out of the condensers on Tests D and E, even though four times as much gas as would normally accompany the amount of tar was passed through; for hydraulic main tars are low in naphthalene and retain tenaciously what they have. With separator tar, the gas was impoverished as previously; but, in addition, naphthalene stoppages made themselves evident before more than half the normal amount of gas had bubbled through the tar.

If any tar in a gas-works should have attained equilibrium with the gas, it is that which is carried past the tar-separator and which separates between the separator and the final condenser. A sample of tar from this source, Test H [Table I.], abstracted from the gas 22 B.Th.U. the first time gas was bubbled through it at 88° Fahr., and 10 B.Th.U. the second time the same tar was used. It appears, therefore, that in ordinary works' practice the tar is separated before it has come into equilibrium with the tar.

The tars which had been used to scrub the gas at ordinary temperature changed in consistency only slightly. Those used at higher temperatures became thick and viscous; so that they would scarcely flow when cold, and resembled the prepared tar used for street paving. The water of the tar had, of course, been completely removed by the scrubbing, as had also some of the lighter oils, which, however, had separated in the condensers and dragged down enough of the illuminants with them to depreciate the gas.

Variation in Tar during Carbonization.

If tar is to be used as a scrubbing agent for gas, its temperature should apparently be that at which it is most nearly in equilibrium with the gas; so that any unfavourable change in candle power will be minimized. How impossible it is to find a single most favourable temperature is shown by a series of analyses of tar and gas produced during successive half-hour intervals of the carbonization process. The salient points are given in Table II. The increase of crude naphthalene, in both the condenser and separator tar at the latter part of the run, is striking. The light oils in the tars decrease in the same direction, as do also the benzol vapours in the purified gas. The tar of the first period tended, of course, to come into equilibrium with the rich gas evolved at the same time, and the high naphthalene tar of the last period tended to come into equilibrium with the lean gas evolved with it. The desirable temperature for scrubbing the gas made in the first part of the run will not be the same as for that made in the last part.

Table II.

Half-Hour Period.	Percentage of Crude Naphthalene.		Percentage of Light Oil.		Per Cent. Benzol in Purified Gas.
	Condenser Tar.	P. & A. Separator Tar.	Condenser Tar.	Separator Tar.	
1	0·8*	0·1	3·6	3·6	3·4
2	0·2	0·2	2·0	3·1	3·0
3	1·3	0·6	3·2	4·5	2·0
4	1·4	2·5	3·4	4·2	1·4
5	3·2	..	2·9	..	0·8
6	5·6	3·2	1·7	0·5	0·7

* This figure is probably high because of the tar left in the condenser from the latter part of the previous run.

The experiments indicate that it will not usually be advantageous to attempt any process involving the use of a hot-tar scrubber, unless it is feasible (as is done with some of the by-product coke-ovens) to separate the rich and poor gas and the rich and poor tar. It should apparently be feasible to improve the quality of the poor gas by scrubbing with the rich tar.

Is Rapid Cooling Desirable?

What is the use of slow cooling from 200° to 100° Fahr.? Would it not be better to do away with the cumbersome air condensers and substitute more compact water-cooled condensers, washer-scrubbers, or similar machines?

Would the candle power or heat value or the gas be injured by rapid cooling? The answer is quite certain that they would not. The more benzol retained in the gas, the better. The quicker the tar is removed from the gas, and the higher the temperature at which it is removed, the better will be the candle power and the heat value of the gas.

Would it be possible to completely remove the tar-fog from quickly-cooled gas by mechanical means? It would certainly be more difficult. The particles of tar grow by accretion and union with one another in the slow cooling process, so that their mechanical removal becomes easier. Any system of rapid cooling would almost certainly require an oil-scrubber to remove the last portions of suspended naphthalene and tar; and even with this there might be difficulty. The experience of other industries has shown that it is almost impossible to remove from a gas small amounts of very finely-divided solids. It is possible that the Cottrell electric process, which has proved itself so successful with smelter fumes, might be applied here also.

The answer to the question is, therefore, apparently that rapid cooling of the gas is only for large works, which can afford oil-scrubbers and the expert attention required for their proper control.

Conclusions.

Rapid cooling of the gas should improve its candle power and heat value, because of the lessened opportunity which the tar has to abstract benzol from the gas. The only apparent valid objection to the rapid cooling of the gas is the difficulty of mechanically removing the last traces of suspended tar which is finely-divided because of the quick cooling, and of removing the naphthalene which the tar has not had an opportunity to dissolve. This may be accomplished by the use of oil-scrubbers; but the process requires skilled supervision to prevent a change in the candle power of the gas.

It was hoped that it might be possible to use tar at a suitable temperature, instead of a special oil in the scrubbers, on the theory that if the tar had been in equilibrium with the gas befcre its separation, neither one could be affected by being brought back in contact with one another at the same temperature at which they were separated. Experiment failed to confirm this theory; the gas losing both in heat value and candle power, under every condition tested, and in most conditions naphthalene stoppages resulting.

In the ideal condensing system, the tar would be separated from the gas the moment it had cooled sufficiently to dissolve all the naphthalene, and while it had a minimum of benzol. But this ideal temperature changes continuously as the distillation of the charge progresses; and it is evidently impossible to do more than fix an approximately most desirable average temperature which will vary for each individual works.

The gas must also remain in contact with the tar a sufficient time to allow the naphthalene to be dissolved by the tar-fog. This time will be longer the lower the temperature. If the condensation is very rapidly effected, the removal of the naphthalene will be due to the cooling effect and not to the tar, which will not have had time to act. The gas will, therefore, after separation of the tar, be saturated with naphthalene, which will have to be removed by special naphthalene scrubbers.

A small gas-works which does not desire to instal naphthalene scrubbers, and which relies on the tar to remove the naphthalene, will not dare to cut down the time for condensing, nor to remove the tar at too high a temperature. It is to be remembered that with the ordinary process of condensation, more than 95 per cent. of the naphthalene is removed by the tar, and that this high removal is accompanied by a loss of less than 10 per cent. of the benzol with the tar. The efficiency of the present process is, therefore, already very high as to elimination of naphthalene in the tar and retention of benzol in the gas. The only advantage of a change for small works where air-condensers act satisfactorily and with little attention, would lie in the gain of a portion of the 10 per cent. of benzol now lost in the tar. This saving would appreciably affect the candle power of the gas, but would barely raise its heating value over 1 per cent. It would hardly justify a great expenditure of time or trouble to attain it. The traditional method of condensation of coal gas seems still the best for the small plant.

MORE VERTICAL RETORT RESULTS.

A paper read by Herr K. Weisskopf, the Manager of the Chemnitz Gas-Works, before a meeting of the Saxony-Thuringian Gas and Water Association at Leipzig in May last, was published in a recent number of the "Journal für Gasbeleuchtung." It relates to vertical retort working with gas coals from Saxony; but there are a number of comparisons of general interest, as will be seen from the following summary of the paper.

The question of the extension of the carbonizing plant at the No. II. Gas-Works at Chemnitz was raised in the year 1908. There were then in one retort-house sixteen settings each of nine inclined retorts, and eleven settings of horizontal retorts, which were charged by means of the De Brouwer machine, and discharged by hand rakes. The inclined settings had not justified their extension, and there were local reasons why carbonizing chambers should not be adopted. The choice therefore remained between horizontal retorts, with charging and drawing machinery, and vertical retorts. Herr Ledig, who was then Manager of the works, decided in the year 1908 to erect a bench of six beds of vertical retorts. Last year the author introduced a second similar bench. Each setting contains ten retorts, about 13 feet in length. The old retort-house was made suitable for these settings by lowering the discharging floor about 30 inches. This

Comparative Results of Carbonizing Trials of Saxony Coals.

Type of Retort.	Vertical.			Inclined.
	First Bench of Six Settings, with Steaming.	Second Bench of Six Settings, without Steaming.	First Bench of Six Settings, without Steaming.	Four Settings.
Name of Pit	Deutschland Schedewitz. Lugau.	Rev. Wilhelmschacht.	Wilhelmschacht, Schedewitz.	
Moisture in coal . . . p. ct.	5·7	5·7	7·1	8·63
Duration of trial . . . days	9	9	5	9
Time of working off charge . . . hours	12	12	12	6
Temperature of setting—				
First level . . . deg. F.	2386	2410	2392	2298
Second ,, . . . ,,	2152	2230	2160	2148
Active life of retorts to date . . . days	690	18	720	550
Make of gas per ton of coal, cubic feet at 60° Fahr., 30 in. bar, saturated	13,127	10,998	11,129	9908·6
Proportion of water gas added . . . p. ct.	..	16·51	15·06	20·65
Calorific power of mixed gas, B.Th.U. per cubic foot, at 60° Fahr., 30 in. bar. saturated	549	549	553	564
Specific gravity of mixed gas	0·447	0·458	0·453	0·472
Coke consumed as fuel—				
Per cent. by weight of coal	14·16	13·45	12·91	14·38
Pounds per 1000 cubic feet of gas made	24·47	27·71	26·12	32·84
Yield of dry coke, per cent. of dry coal	61·04	63·82	64·70	63·66

avoided raising the roof of the house. The coal-elevators at the back of the house were lengthened, and the coal-bunker raised about 40 inches. These were substantially all the structural changes required.

Passing on to the working of the vertical retort-settings, the author points out that the figures he gives are not spectacular figures obtained in a day's trial under the supervision of the engineers of the constructing firm. No representative of the constructors was present during the trials reported on, which were made by the Superintendent of the No. II. Works, Herr Schipke, and his assistants. The gas-works possesses two separate sets of apparatus; and it was therefore possible to carry out trials of the two benches of settings simultaneously. In this way, figures were obtained for working in the one case without steaming, and in the other case with steaming. The gas made without steaming was broken-down by an addition of water gas until the calorimeter showed that the two benches were giving gas of the same calorific power—viz., an average of 549 B.Th.U. gross per cubic foot. The first bench had at the beginning of the trials on Sept. 26, 1910, already been in use for 690 days, and the second bench for 18 days. The first bench was in these trials, which extended over nine days, worked with steaming, the second bench without steaming. But a trial of five days' duration was afterwards made with the first bench without steaming, and the results differed very little from those obtained in the trial of the second bench, thereby indicating that the settings were, after 720 days' use, still working perfectly.

The coal carbonized was screened coal from the Zwickau, Ölsnitz, and Lugau coal-fields of Saxony. The weight carbonized was determined by weighing about fifteen charges out of the sixty charges made in twelve hours, and adopting the average weight thus ascertained. The number of waggons of coke used as fuel was counted, and the weight computed from the average weight of dried coke contained in such waggons. The coke recovered from the clinker was dried and weighed. The yield of coke was determined by lightly quenching and weighing after cooling; the moisture being determined on an average sample taken at the time. For comparative purposes, a nine days' trial was made on the inclined settings at the works. The make of gas in this trial was, however, low, and the fuel consumption high, because two out of the four settings used were not heated properly owing to a settling of the structure. The results of the trial runs are summarized in the annexed table.

The coke was denser and harder and produced less breeze in transport than ordinary gas coke. The gas take-off pipes are cleaned once in 48 hours, and the retorts scurfed once in eight or nine weeks. The scurfing occupies on the average twelve hours. One setting has now had the producer fitted with a step-grate, which only requires pricking of the fire once in eight hours, and in a four days' trial has shown an economy of fuel consumption which is equivalent to a reduction of 0·8 of the coke consumed per cent. of the coal carbonized. The step-grate avoids clinkering and the lowering of temperature which ensues with the ordinary grate after each clinkering. The lower proportion of naphthalene in the vertical-retort gas has been responsible for a considerable reduction in the consumption of oil for naphthalene extraction by washing, even when the vertical retort gas has amounted to only 10 per cent. of the whole. Later, with 44 per cent. of vertical-retort gas, the washing oil required renewal only after 2,207,230 cubic feet of gas had passed through it; and still later, when the gas was practically all from the vertical retorts, the chambers of the washer proved to contain only traces of naphthalene after 70 million cubic feet of gas had passed through them. An increased yield of about 30 per cent. of sulphate of ammonia has been attained.

The vertical retorts have naturally produced a great economy in wages. Taking all retort-house work into account, the daily output of gas per man with the inclined settings is 52,373 cubic feet, with the vertical retorts without steaming 91,821 cubic feet, and with steaming 108,313 cubic feet. If the coal-bunker were over the settings, the output of gas per man with vertical retorts without steaming would be 114,776 cubic feet per diem; and with steaming, 135,612 cubic feet. These figures take into account the handling of the coal and coke in the retort-house.

The final results show that, in the year 1910, 163,655,000 cubic feet of gas were made at the No. II. Gas-Works in inclined retorts, and 315,086,000 cubic feet in vertical retorts; and that if the gas made in vertical retorts had been made in the inclined retorts, there would have been an increase in working expenses of £2240. The cost of the installation of vertical retorts was about £8000 higher than the cost for inclined retorts or horizontal retorts with machine stoking. Taking this into account, and allowing 15 per cent. for interest and depreciation charges, there remains a saving of 0·8d. per 1000 cubic feet of gas made. By May last, the first bench of vertical retorts had been in use for 900 days—except for a short time in 1909—uninterruptedly. When they have completed 1000 days' use, they will be let down, and new retorts will be put in two out of the six settings, while in another two settings the lower sections of the retorts will require renewal. This experience indicates, it may be contended, that the durability or life of the vertical settings is likely to exceed that of horizontal and inclined settings.

LABOUR TROUBLES AND THE PUBLIC SERVICES.

[Communicated.]

In view of recent events, it cannot, we think, be denied that organized labour is determined in the future to assert itself without consideration of the public weal. It would not be surprising, therefore, to find the moral obligation now imposed upon those who are responsible for the public services—such as the supply of gas, electricity, water, conveyance by railway, &c.—converted into a legal necessity, and the owners of these undertakings, possessed as they are of monopolistic powers, being required to show that, notwithstanding the stoppage of transport facilities and the supply of fuel, they are able to save the public from the calamitous consequences of a cessation of such services. So far as gas-works are concerned, the accepted safe storage of raw material at the present day is six maximum weeks' requirements. This represents one-fourth of the annual quantity of coal purchased, and involves considerable expense as well as room for its accommodation. Whether or not other means can be provided for meeting such emergencies by plant of a different type, is for the authorities concerned to determine. Gas-works have, fortunately, at their call, in the form of carburetted water-gas plant, a means of meeting the difficulty to a great extent; and we should not be surprised to see in the immediate future considerable development on these lines.

It is claimed that the interest and other charges on laying down a full stock of coal are more than sufficient to pay capital charges on such a plant, if it is used only for emergency purposes of the character indicated. The convenience of plant has been undoubtedly established, for we know of no works where modern water-gas plant has been installed in which it has not continued in use. It has many advantages, though in some situations its production may cost more than coal gas. It has collateral advantages more than equalling the fractional increase in the bare cost of production; and the small area occupied per unit of output and the saving of space on which otherwise the larger store of coal must be kept, seem to point to the necessity for its installation in every gas-works.

Leeds University Lectures.—We learn that a special course of 22 lectures (in two parts) on "The Chemistry of Coal and the Manufacture of Coal Gas" will be delivered at the Leeds University by Professor W. A. Bone and Dr. Harold G. Colman, on Wednesday evenings at six o'clock and Thursday mornings at nine o'clock, commencing on Jan. 10. There will also be a course of eight lectures on "Refractory Materials," by Mr. C. D. M'Court, on Saturdays at three o'clock, commencing Jan. 13.

COKE PRODUCTION IN THE UNITED STATES.

According to some particulars, extracted from the "Mineral Resources of the United States for 1910," which are given in the current number of the "Journal of the Society of Chemical Industry," the quantity of coke produced in the year named was 41,708,810 short tons, valued at $99,742,701, compared with 39,315,065 tons and $89,965,483 in 1909. The quantity of coal used for coking in 1910 was 63,088,327 short tons. There were 578 coking establishments in existence at the end of the year, representing 104,440 ovens. Nine establishments, representing in all 894 ovens, were abandoned or dismantled, and 100 establishments were idle during 1910.

With regard to bye-product ovens, in 1910 there were 4078 completed and 1200 building. Their production amounted to 7,138,734 short tons of coke—an increase of 884,090 short tons over 1909. Of the completed ovens, 1387 were of the Semet-Solvay type, 2104 United Otto, 307 Rothberg, and 280 Koppers; of those building, 900 were Koppers and 300 Didier. The total value of the coke, gas, tar, ammonia, &c., produced at bye-product recovery ovens during the last three years is given in Table I., while in Table II. is shown the value of the coal-tar products imported into the United States during the past four years.

TABLE I.

	1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gas . . . . . 1000 c. ft.	16,205,925	$2,557,483	15,791,220	$2,609,211	27,692,858	$3,017,908
Tar . . . . . gallons	42,720,609	1,007,613	60,126,006	1,408,611	66,303,214	1,599,453
Ammonia, sulphate or reduced to equivalent in sulphate . . . . . pounds	43,329,426	1,286,224	123,111,197	3,227,316	70,247,543	1,841,062
Ammoniacal liquor . . . . . gallons	..	..	..	..	4,654,282	295,868
Anhydrous ammonia . . . . . pounds	15,445,030	2,530,979	4,871,014	448,455	20,229,421	1,725,266
All other products	..	..	..	380,355	..	..
Total value of bye-products	..	7,382,299	..	8,073,948	..	8,479,557
Coke . . . . . short tons	4,201,226	14,465,429	6,254,644	20,434,689	7,138,734	24,793,016
Grand total	..	21,847,728	..	28,508,637	..	33,272,573

TABLE II.

Year.	Salicylic Acid.	Alizarin and Colours or Dyes, Natural and Artificial.*	Aniline Salts.*	Coal Tar Colours or Dyes not specially Provided for.†	Coal Tar, all Preparations, not Colours or Dyes.‡	Coal Tar Products not Medicinal, not Dyes known as Benzol, Toluol, &c.*	Total.	
							Value.	Duty.
1907	$1240	$782,368	$667,758	$5,830,651	$911,096	$653,288	$8,846,401	$1,931,904
1908	1183	752,386	450,891	4,573,217	717,556	549,352	7,044,585	1,515,821
1909	..	1,191,874	553,593	6,431,767	693,608	960,724	9,831,476	2,068,298
1910	..	430,393	501,369	5,867,331	594,252	962,232	8,355,577	1,878,947

* Free of duty. † Duty 30 per cent *ad valorem*. ‡ Duty 20 per cent. *ad valorem*.

REGISTER OF PATENTS.

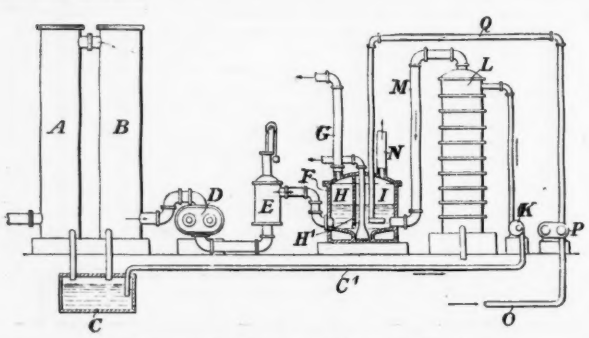
Recovering Ammonia from Coal Gases.

ROTERMUND, H., of Düsseldorf, Germany.

No. 21,409; Sept. 14, 1910.

This invention relates to "the recovery of ammonia from coal gases and other gases obtained in the dry distillation or carbonization of coal or other carbonaceous materials."

In the manufacture of sulphate where the gases of carbonization are directly conducted into an acid solution contained in a saturator for the purpose of extracting from them the ammonia they contain, particularly in the form of sulphate of ammonia, a certain amount of condensation of watery vapour (the patentee points out) takes place, which dilutes the acid solution to such an extent that separation of solid sulphate of ammonia is prevented thereby. To obviate this disadvantage, he conducts the gases through one compartment of the saturator, while through the other compartment (into which also may be led any vapours arising from the distillation of the ammoniacal liquor, if produced during the process) he blows a current of hot air or hot products of combustion in such a way that the current is not mixed with the gases of carbonization, and, on leaving the saturator, carries with it a sufficient amount of watery vapour to maintain the concentration of the acid solution at such a point that sulphate of ammonia separates out in solid form.



Rotermund's Sulphate of Ammonia Plant.

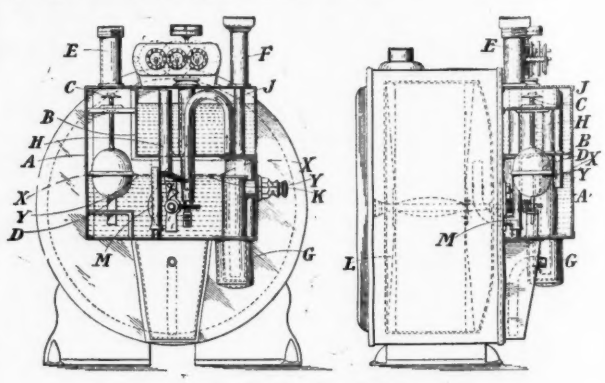
The illustration represents diagrammatically suitable apparatus for carrying out the invention. A and B are coolers, through which are passed the gases to be treated and in which tar and ammoniacal liquor are deposited; the tar and liquor collecting in the tank C. D is an exhauster, into which the gases pass from the coolers, and E is a tar extractor. F is a saturator divided into two compartments H I by a partition which dips down into the acid solution in the bottom of the saturator. The gases to be treated after leaving the tar extractor enter the compartment H and, after passing through the solution, leave by the pipe G. L is an ammonia still which is supplied with ammoniacal liquor from the tank C through the pump K, and M is a delivery pipe from the still, which conveys the products of distillation from the latter to the compartment I of the saturator. The products, after passing through the liquid in the saturator, leave the latter by the pipe N. O is a supply pipe for the hot air or hot products of combustion, drawn by the pump P and blown through the pipe Q into the solution in the compartment of the saturator.

Wet Gas-Meters.

WILSON, G., of 's-Gravenhage, Holland.

No. 27,504; Nov. 25, 1910.

This invention has for its object "to eliminate errors in the meter due to alteration in the level of the liquid in the meter caused, for example, by evaporation of the liquid contained therein."



Wilson's Wet Gas-Meter.

In the front casing A of the meter is fixed a reservoir B, which does not extend completely across the front but (as shown) space is left to contain a valve C, governed by a float D, which serves to govern the admission of gas from the inlet pipe E. The reservoir is fitted with a filling pipe F, which extends above the casing and into a well portion G of the reservoir. A vertical gas-pipe H (open at both ends) connects the reservoir with the meter; the lower end of the pipe being substantially at the normal level of the liquor in the meter. On the side of the pipe, just above the lower open end, is a small vent hole. The pipe is slightly above the normal level of the liquid, so that the liquid seal formed on the open end of the pipe is readily broken when the level of the water in the meter is lowered, for the purpose to be hereafter described. A syphon J also connects the reservoir B with the meter; the

shorter limb of the syphon being slightly above the bottom of the reservoir, while the longer limb extends below the normal level of the liquid. A small slot is cut in the longer limb of the syphon (the end of which is closed) where it extends below the normal level of the liquid such that, when the liquid descends the lower limb, it is caused to impinge in a jet on the lower open end of the pipe H. A plug K is fitted in the casing, so as to allow the escape of liquid until the liquid in the casing attains its normal level. The meter itself is provided with the usual measuring apparatus—being provided with a drum L in the main casing and operating the measuring device in the known way. A pipe M is provided to withdraw the gas from the meter through the bent pipe shown, and also serving as an over-flow pipe.

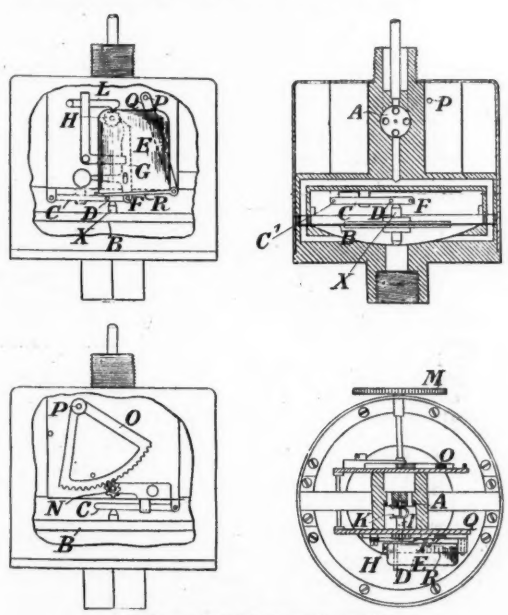
In order to start the meter, liquid is introduced into the filling pipe F to completely fill the reservoir B and overflow through the syphon J into the outer casing A of the meter. When no more liquid escapes from the plug K, the plug is closed, and the meter will then have been filled to the normal liquid level—the dotted line X—X. If now the gas is turned on, it will flow in at the inlet pipe E, which is controlled by the valve C. It is well known that the level of the liquid in the front casing of wet meters is depressed slightly, due to the loss of pressure between the inlet and outlet caused by the friction of the working parts of the meter. The water line when working is indicated by the full line Y—Y. The gas-pipe H, which has been sealed at its lower end by the liquid filling the meter, then becomes unsealed, and so the reservoir B receives gas through the pipe H which causes the syphon to come into operation, and by a jet of water from the slot in the syphon J impinging on the bottom end of the gas-pipe H, it once again seals the pipe. The vent hole in the gas-pipe H serves the purpose of allowing the liquid seal to be easily broken; and the syphoning of water out of the reservoir B is thus instantly stopped. On the slightest evaporation of the liquid from the meter, the pipe H is again opened to the passage of the gas, so that the syphoning action again commences and sealing of the pipe H is again effected. Thus the liquid in the meter is kept at a constant level—allowing no variation in registration during working.

Operating Gas-Valves for Burners from a Distance by Gas Pressure.

PANKOW, O., of Dudweiler-on-the-Saar, Germany.

No. 2907; Feb. 4, 1911. Date claimed under International Convention, Feb. 7, 1910.

This apparatus for operating gas-valves for burners from a distance by gas pressure is of the kind in which, by alteration of the pressure operating a diaphragm or any other equivalent means, gearing is caused to open or close the gas passage. Devices of this kind are known, the patentee mentions, in which the diaphragm is loaded by weights. In these devices suitable weight plates must be used for adjusting the pressure; and the most suitable weight for a given pressure is hard to determine. In another type of such devices the weight does not act directly upon the diaphragm but indirectly by means of a one-armed lever. The pressure of the load is in this case adjusted by shifting the weight upon the lever arm. This is a disadvantage, in that if the lever upon which the weight is adjusted is arranged within the casing, it is necessary when adjusting the pressure to each time remove the cap covering the weight and open the apparatus. On the other hand, if the lever carrying the weight is made to project outwardly from the casing, the weight may be displaced by unauthorized persons. Another drawback of such an arrangement is that dust can enter the interior of the casing through the opening provided for the lever.



Pankow's Gas-Pressure Regulator.

The present invention has for its object to enable the weight placed in a closed casing to be adjusted in relation to the diaphragm without opening the device, by so mounting the weight that its centre of gravity may be altered with regard to the bearing arranged upon the diaphragm by means of an oscillatory arm adapted to be moved from outside.

The illustration shows a front view of the device, a vertical section, a rear view, and a horizontal section.

Upon the pin X fixed on the centre of the diaphragm B rests the free end of a one-armed pivoted lever C provided with lateral pins F D. A pawl G is mounted upon the pin F and co-operates with a ratchet wheel H provided with a counter pawl L. The weight E is fixed upon a one-armed lever R, which is pivoted to an oscillatory arm Q fast on one end of a spindle P. The free end of the lever R rests upon the pin D of the lever C. Fast on the other end of the spindle P, a toothed segment O is mounted; and this engages a geared wheel N mounted on one end of a spindle passing through the apparatus. The spindle, at its other end, is provided with a disc M, arranged outside the casing. By turning the disc the arm Q is moved to the right or left by the gear wheel N and toothed segment O fixed upon the spindle P. At the same time the lever R carrying the weight E and pivoted to the lever Q is displaced to the right or left. By this displacement, the centre of gravity of the weight is moved more or less towards the bearing D upon lever C, and is consequently moved with regard to the point at which the pressure is transmitted to the diaphragm, so that the pressure upon the diaphragm is correspondingly altered. In this manner the working pressure may be adjusted by disc M as desired, without its being necessary to open the casing.

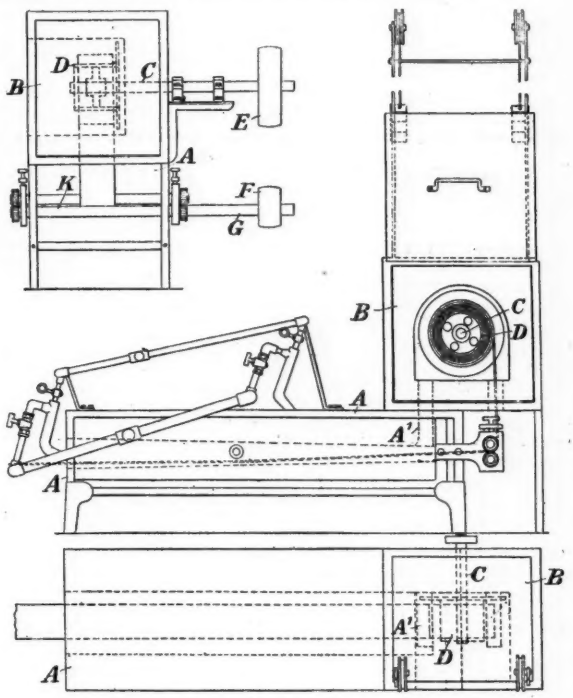
Upon the diaphragm B being raised by a pressure-wave produced in the gas-main, the ratchet wheel H is rotated by the lever C and the pawl G. By this the shaft I and a slide coupled to the shaft by a bent spring K are rotated in such a manner as to open or close the gas passage to the burners fitted on the apparatus.

Gas-Heated Metal-Working Furnaces.

FLETCHER, RUSSELL, AND CO., LIMITED, and FLETCHER, T. W., of Warrington.

No. 4753; Feb. 25, 1911.

This invention relates to gas-furnaces for heating metal bands that require tempering, and furnaces in which wire to be drawn to a gauge is placed in bundles in an oven, and when heated is drawn through rolls in front of the furnace. The object aimed at is to enable long lengths of materials that require tempering or wire to be drawn to be heated conveniently and quickly without requiring increased space.



Fletcher-Russell's Gas-Heated Metal-Working Furnace.

There are shown a side view, a plan, and an end view of such a furnace.

The invention consists in mounting at one end of an ordinary horizontal gas-heated furnace a case or chamber B, heated by the hot air from the furnace passing into the chamber through the flue A^1. The chamber is closed when required by a sliding door balanced by weights. The door is shown open in order to obtain a view of the interior. Transversely in the centre of the chamber B is fitted a shaft C, with a pulley D on the inner end of it. The opposite end of the shaft extends through and beyond the back of the chamber, where (supported on brackets) it carries a pulley E, connected by a band or strap to a pulley F on a shaft G with two sets of pinions that gear into each other. The shafts thus form a pair of guide rollers K, which are below the chamber B.

Purifying and Cooling Gases.

ZSCHOCKE, H., of Kaiserslautern, Germany.

No. 7754; March 28, 1911.

The purification and cooling of hot gases containing mechanical impurities and mixed with vapours is effected according to this invention without the assistance of water.

A process is already known, the patentee points out, in which the purification of hot gases containing mechanical impurities and mixed with vapours is effected by a dry operation, the cooler only being operated with water. In this process the apparatus is arranged in the

following order (see fig. 1): (1) Dust receptacle, A; (2) preliminary cooler, B; (3) reheater, C; (4) filter, D; (5) fan, E; (6) final cooler, F; and (7) water separator, G.

Fig. 1.

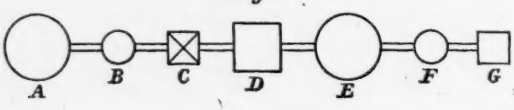
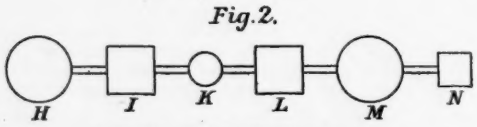


Fig. 2.



Zschocke's Gas Purification Process.

In the process in accordance with the present invention, the gases to be purified and cooled are carried by the pressure of the gas generator and the suction effect of a fan through apparatus arranged as in fig. 2—viz., (1) Dust receptacle, H; (2) preliminary filter, I; (3) fan, K; (4) final filter, L; (5) cooler, M; (6) water separator, N.

The essential difference between the two processes resides in the fact that in accordance with the earlier practice the water operated cooler B is arranged in front of the filter D and the fan E after the filter. When the cooler is arranged in front of the filter it becomes necessary to interpose a reheater C for the gas between the cooler and the filter, in order to prevent condensation of the vapours contained in the gases inside the filter. Furthermore, when the reheater is inserted in front of the filter it becomes necessary to provide a final cooler F after the fan E, in order to carry off again the heat supplied to the gas in the reheater C.

Illuminating by Means of Gas.

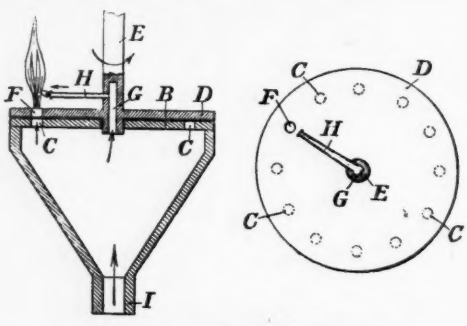
DELAUNAY, H. M., of Fécamp, France.

No. 8942; April 10, 1911. Date claimed under International Convention, Jan. 13, 1911.

This specification describes "a method or process and an apparatus for economical illumination by means of any suitable combustible gas or vapour," and is "based on the persistence of luminous impressions on the retina."

It is known (the patentee points out) that, when the supply of gas to a burner is cut off suddenly, the light is extinguished immediately, but the eye continues to perceive the light for "a very appreciable time," which experiments have shown to be equal to about one-tenth of a second. If the burner be relighted before the image on the retina has had time to be effaced—that is to say, less than one-tenth of a second after the extinction of the flame—the eye does not cease to see the flame alight, as well as the objects which it illuminates.

The process which forms the object of the present invention is based on this principle; and it consists in lighting a gas-burner every one-tenth of a second for a very short time (for example, the one-hundredth of a second). By reason of the persistence of the images on the retina, the effect produced on the eye will be the same as if the jet at the burner remained continually alight, although it is extinguished during the greater part of the time.



Delaunay's Intermittent Gas-Burner.

The illustration shows an apparatus for enabling the process to be carried into practice—a vertical section, and a plan.

The apparatus consists essentially of a casing the upper part of which is formed by a plate B having a circular series of holes C, and by a plate D concentric with and resting on the plate B. The plate D is capable of receiving very rapid rotary motion by means of a shaft E mounted in its centre. The plate D is provided with a hole F, which in the rotation of the plate registers successively with each of the holes in the plate B. Finally, the shaft E extends into the interior of the casing, and has an internal passage G which communicates with a radial nozzle H, the end of which opens above the plate D opposite the hole F.

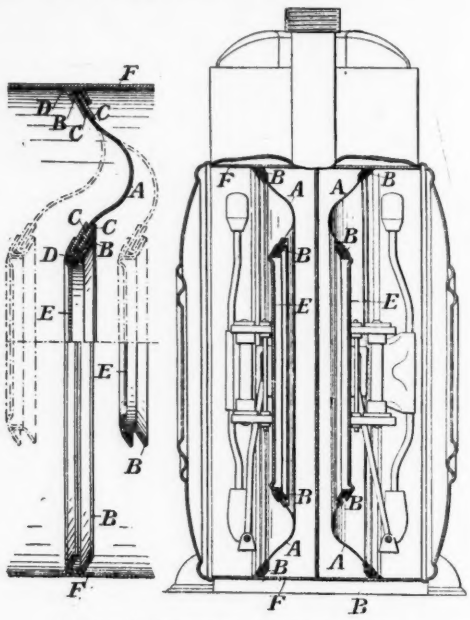
The operation of the apparatus is as follows: On gas being delivered into the casing, the jet which issues from the nozzle H is lighted. The apparatus is then started so that the shaft turns at a speed of at least 600 revolutions per minute. Under these conditions, each time the orifice in the plate D comes opposite one of the holes in the plate B, a jet of gas darts out and ignites by contact with the flame at the nozzle H. There will thus be formed successively, at each revolution of the plate D, as many flames as there are holes in the plate B; the flames being extinguished immediately after they are lighted. But, by reason of the high speed of rotation of the shaft, "the flames relight before their image has had time to be effaced from the retina—just as if the eye saw a ring of flames constantly burning, whereas in reality there is only a single flame travelling round the apparatus and alternately lighting and being extinguished." Thus, "with a quantity of gas less than that which would be necessary to produce a fixed flame, there is obtained the same luminous effect on the eye as would be attained with a large number of flames arranged in a ring."

Dry Gas-Meters.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Paris.

No. 10,712; May 3, 1911. Date claimed under International Convention, May 9, 1910.

This invention (relating to the bellows of dry gas-meters) has for its object "improved arrangements of the membrane and its method of attachment to the internal walls of the meter, whereby the working of this type of apparatus is improved as regards constant correctness in measuring, the absorption of pressure, and permanent gas-tightness of the membrane." The membrane is of annular channel formation with divergent edges, secured with the aid of joint-pieces in annular concentric flanged rings inclined in opposite directions—one attached to the central rigid part of the bellows, and the other to an internal wall of the meter casing—in such positions that the membrane is bent in one direction only by the pulsation of the bellows.



A French Construction of Dry Gas-Meter.

The illustration shows a vertical section of the bellows according to the invention (one part showing the fixing rings of the membrane), and a vertical section of a meter containing two bellows.

The bellows comprises a flexible membrane A, the edges of which (of suitable shape but preferably circular) are fixed in metallic rings interposed between the rings B and the membrane. Joint-pieces C (of a malleable alloy or other flexible material) prevent leakage of gas past the points of fixation of the membrane, and to prevent the latter being crumbled or cut during its movements by the fixing rings. This arrangement has the advantage of obviating any folding or cutting, and enables each bellows to be fixed in the meter by a simple soldered joint D without the heat developed during the operation injuring the part of the membrane in contact with the gas, this part being remote from the place of soldering.

To the internal attachment ring B is fixed a metal disc E which constitutes the central part of the bellows, to which is attached a guiding arrangement and also the rods or other members which drive the distribution and the registering mechanism.

It is pointed out (and this detail "constitutes one of the most essential features" of the new bellows) that the flanges of the rings which hold in place the membrane are not directed normal to the wall F of the meter and to the edge of the movable disc E to which they are soldered. They are inclined on the walls E F; and the membrane itself is formed in a matrix which causes its inside and outside edges to diverge and assume the inclination of the attachment rings B and (at its free part) a curvature having a development sufficient to enable the membrane to execute its pulsations without ever being stretched between its two rings B. The inclination of the attachment rings and the particular curvature of the membrane have for their object to provide that the pressure of the gas which is alternately directed towards both faces of the membrane, should oblige this latter to bend in the reverse direction to that shown. It will be seen that the inclination of the rings compels the membrane to remain always bent in the first direction shown, whatever the direction of thrust of the gas. The consequence is that it does not undergo contraction, extension, nor pronounced deformation during its movements, which are effected regularly without variations in the loss of charge and in the pressure or issue. Moreover, the arrangement described reduces to a minimum the fatigue to which the membrane is subjected during its pulsations; since it accompanies the movements of the bellows—being always bent in the same direction without its curvature sensibly changing at the places near the attach-

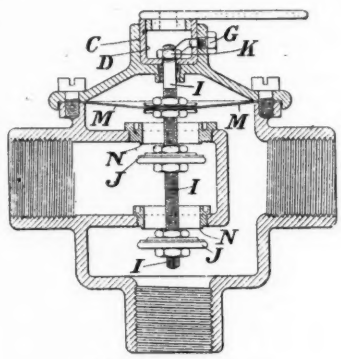
ment rings. Consequently the latter are not subjected to the shearing actions which are produced when the membrane is arranged in such a manner that it is alternately bent in both directions by the thrust of the gas.

Gas Governors.

ZÖLLER, K., of Nordhorn, Germany.

No. 17,543; Aug. 1, 1911.

This invention relates to governors or regulators of the diaphragm or bell type—providing means whereby the valves can be closed from outside and the flow of gas through the regulator stopped when desired.



Zöller's Gas Governor.

The regulator is of the usual type; and in the upper outside of the cover is a chamber C in which is a thimble D, having a hole in its base and an angled or curved slot in its side. The thimble is held in the chamber by its pin G passing through the walls of the chamber and engaging an angle or curved slot. Through the hole and also a gland in the cover is passed the rod I, carrying the valves J; and on the end of the rod (inside the thimble) is affixed a nut K.

In the ordinary course, the thimble is resting upon the bottom of the chamber C—the valve being at the full open position, but subject to being moved from that position to the full closed position by the pressure of gas on the diaphragm M; but when it is required to turn off the gas completely, a key is inserted in the thimble and turned. This causes the thimble to revolve and (by action of the pin in the slot) to rise also, so that the bottom of the thimble acting upon the nut K lifts the valves J, and closes them on their seatings N so as to shut off the gas. A reverse movement of the handle causes the thimble to lower and allows the valves J to drop.

APPLICATIONS FOR LETTERS PATENT.

21,098.—FARNHAM, R. V., "Gas-producers." Sept. 25.

21,112.—IONIDES, A. C., "Regulation of the proportions of fluid mixtures, also applicable to the control of the flow of a single fluid." Sept. 25.

21,119.—HOEGERSTAEDT, E. C., and SCHWARZ, E., "Mechanical scrubber." Sept. 25.

21,268.—HOLZWARTH, H., and JUNGHANS, E., "Gas-turbines." Sept. 26.

21,277.—SEDGWICK, E. A. E. & M. B., "Gas-fires." Sept. 26.

21,285.—HIGHAM, F., and TURNER, A. E., "Regenerative gas-lamps." Sept. 27.

21,315.—ZDANOWICH, J. O., "Mantles." Sept. 27.

21,335.—VICE, A. C., "Gas-stoves." Sept. 27.

21,342.—WRIGHT, W. H., "Pressure-governors." Sept. 27.

21,347.—WILLIAMS, H. A., "Air or gas compressors." Sept. 27.

21,350.—BUNZEL, H., and BAYERISCHE AKT.-GES. FUR CHEMISCHE UND LANDWIRTSCHAFTLICH-CHEMISCHE FABRIKATE, "Causing masses of material to be permeated by gases." Sept. 27.

21,363.—SOUTHEY, A. W., "Production of gaseous fuel." Sept. 27.

21,374.—ROLLASON, A., "Manufacture of gas." Sept. 28.

21,390.—WRIGHT, G. H. G., "Gas-heated iron." Sept. 28.

21,405.—CLOKE, W. G., "Gas-stoves." Sept. 28.

21,439.—MORRISON, E. J., "Controlling valves at predetermined times." Sept. 28.

21,453.—HOLMAN, S., "Retort-lid fastenings." Sept. 28.

21,455.—LEA, J. W., "Mantles and mantle protectors." Sept. 29.

21,532.—GOTUZZO, S. G., "Bucket chain elevators." Sept. 29.

21,533.—ROSE, A., and BELLAMY, W., "Incandescent burners." Sept. 29.

21,545-6.—GREAVES, H. J., "Washing coal or coke." Sept. 30.

21,586.—SCHLEE, C., "Lighting appliances." Sept. 30.

21,605.—COLE, S. W., "Washing, purifying, and cooling air and gases." Sept. 30.

21,609.—HUMPHREY, H. A., "Raising liquids." Sept. 30.

21,617.—FENLON, H. T., "Gas-boilers." Sept. 30.

Price of Gas at Lampeter.—At last Thursday's meeting of the Lampeter Town Council, complaints were made by the Streets Committee with regard to the price of gas. Alderman Evans, in moving that application be made to the Gas Company for a substantial reduction, said there were serious complaints; and if the Company placed themselves in a modern way of business, he contended that they could lower their charges. The Mayor (who is also Chairman of the Gas Company) remarked that the Company had already decided, as an experiment, to reduce the price to users of power to 4s. per 1000 cubic feet; the reason for this being that the gas was used in the day time. The motion was carried.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Mr. Paternoster's Working at Felixstowe.

SIR,—In reading your "Editorial Notes" with reference to my address to the Eastern Counties Gas Managers' Association, I notice you suggest that there are one or two points upon which it would be interesting to be more fully informed.

The first refers to my statement that I do not yet feel satisfied as to the suitability of vertical retorts for small works. I am, however, quite open to conviction on this matter, and shall anxiously await particulars and working results of an installation which may contain in the way of a unit the nearest approach to a bed of six 10 feet retorts, which, in my opinion, is a sufficiently large one for (say) a 50-million works.

With regard to the figures I gave when speaking of the mixture of coal and blue water gas, I regret that I am unable to give the gross and net calorific values for each gas at the time of admixture; but I have made a few tests of the coal gas when mixing has not been taking place, and have found it to average 622·1 B.Th.U. gross and 571·6 B.Th.U. net. The gross figures, from which were derived the net calorific value of 553·8 and 489·1 given for the mixture, are 612·3 B.Th.U. and 536·6 B.Th.U. respectively.

You will quite understand that laboratory work is not very extensive on a 40-million works, and that, having once decided upon a certain standard, it is only possible to find time for such tests as are necessary to ensure the least possible variation. When time permits, I shall hope to make a series of testings which your remarks suggest to me; and if at some future meeting I should be invited to present a paper on the matter, you may rely upon it that all possible details will be forthcoming.

I am very grateful to you for your opinion that I am doing exceedingly well in the matters of calorific value, make per ton, and consumption of benzol. But I can assure you that the results only confirm those obtained at other works where similar plant is in operation, and which I visited previous to recommending my Directors to instal a blue water-gas plant. It should be noted that the figures I quoted for benzol are per 1000 cubic feet of mixed gas, not water gas. On the 11·63 per cent. mixture quoted in my address, this amounts to 0·33 gallon; and this is quite an average figure.

Referring to the question of the deposits found in the hydraulic mains, liquor pipes, &c., the sample to which you allude was taken from the suction of the pump used to pump liquor from the storage well for sulphate making; and a similar substance is found adhering to the sides of the tanks.

In conclusion I must ask you to accept my sincere thanks for your kind words in appreciation of my address.

F. M. PATERNOSTER.

Felixstowe, Oct. 6, 1911.

Who are the Gas Companies, and Who the Gas-Stove Firms?

SIR,—I am sorry that I had no opportunity of replying to your remarks in your issue of the 26th ult.

The statement I made in my previous letter to you is one that is based on fact; and this department was actually concerned in the matter.

We were in close touch for a fair size electric cooking installation for a block of flats; and owing to the fact that when the order was placed, if it were placed with us, short time would be allowed for delivery, all details of the necessary range were got ready, including the quotations from a firm of gas-stove manufacturers who would be supplying the castings for the ovens.

Eventually the contract was placed with us, and we nearly got into serious trouble by reason of not being able to deliver in time; for, on the order being placed for the castings for the ovens, it was refused on the grounds I have already indicated.

I do not choose to give the names of the firms concerned for publication; but if your representative cares to call here, I have no doubt I shall be able to prove to him that the statement I have made was based on fact.

When you have satisfied yourself that this is so, will you be good enough to reply to the query which I raised in my original letter?

H. H. HOLMES,

Sales Manager, Borough of St. Marylebone Electric Supply.

York Place, W., Oct. 7, 1911.

[Our correspondent refers vaguely to some isolated incident that has evidently caused him a little irritation. But let us remind him of the character of the charge that he made in his previous communication. He asserted that "gas companies" (plural) had threatened to withdraw gas-stove orders from "manufacturers" (plural) who supply castings for electric cooking-ranges, and that this had effectually stopped "some firms" (plural) supplying "castings for electric cooking" [*sic*]. We asked him for the names of the gas companies (plural) and the names of the firms (plural). Now Mr. Holmes refers to what we have termed an isolated incident; and adds "I do not choose to give the names of the firms concerned for publication." Now why not? Mr. Holmes, in his original letter, when he scattered his charge over more than one gas company and more than one firm, said "it is a fact." Being "a fact," he has nothing to fear from publication. On two conditions, we will send a representative to see him as he requests; and they are: (1) That he divulges the names of the gas companies and firms alluded to in his original letter, and (2) gives us permission to publish them. We are anxious to get at the bottom of the wholesale charge contained in his former letter, which, placed side by side with the present one, appears to have been somewhat extravagant. There are

no apprehensions in gas circles that electric cooking is going to be a keen competitor with gas; so that we cannot give any reasons for any such action as he imputes. We hope to hear that he accepts our conditions.—ED. J.G.L.]

"Luxometer."

SIR,—In your issue of this week, you have a notice of an ingenious contrivance which has been styled (oh, horror!) "Luxometer." The word is enough to give one the sensation of goose-skin all over. The author of this barbarism should have ascertained that, while the Greek *phos* makes *photos* in the genitive case and therefore the compounded word *photometer* is correct, the Latin *lux* makes *lucis* in the genitive and therefore the compound should be *lucimeter*—a word at once accurate and euphonious. Compare *calor, caloris, calorimeter*. Is it too late to mend?

Oct. 5, 1911. H. D. ELLIS.

Necessity for a Publicity Association.

SIR,—It has occurred to me that, in view of the publicity meeting on Thursday, a reference to the enclosed leaflet in the "JOURNAL" of next week would probably serve a good purpose by drawing attention to the necessity for an Association having for its main object the promotion of the "Commercial Prosperity of the Gas Industry by Co-operative Action."

Oct. 5, 1911. SECRETARY.

[The leaflet enclosed by our correspondent is one of a batch which reached us early in the year, and were dealt with in the "JOURNAL" for Feb. 21. By way of complying with his suggestion, it may be of nterest to reproduce our remarks upon it.

Another leaflet deals with "Electric Light and Safety." But there is only this mere postulation as to the safety of electricity: "Electric light *is* a safe light. It has none of the dangers of gas." Dead silence on the risks of electricity, as proved by fatal fires, and as to the hundred-and-one rules and regulations of the Institution of Electrical Engineers, the Fire Offices, and Government Departments. Not an instance of a fire generated by electricity is mentioned. But an extract is made from the "Pall Mall Gazette" in which there is the allegation, which has not been sustained by the evidence—indeed, all the evidence points to the contrary—that the fire on the wrecked Scotch express in December last was due to the gas lighting of the train, part of which was electrically lighted. Then we have preceding another extract the heading "House Cut in Two: Extraordinary Effects of a Gas Explosion," another "Gas Explosion at Workhouse," yet another "Gas Explosion: Alarming Incident at a Bullwell Factory," and so on. Not a word about the poor girls and others whose deaths have been due to fire originated electrically. The day when these circulars will have to be answered approaches—perhaps we should say is here; and their character calls for the effective answer provided by electrical experience.

Our correspondent will see, from the concluding remarks, that the present publicity movement was foreshadowed.—ED. J.G.L.]

Dispute as to Gas-Governors.

At the Southwark County Court, on Monday last week, before his Honour Deputy-Judge Layman, an action was brought by Messrs. Tice and Co. (New Company), Limited, of Union Street, Southwark, S.E., against Messrs. Daniel Doncaster and Sons, Limited, of Sheffield, to recover payment for two gas-governors supplied to them. The governors had been purchased on the understanding that they would effect a saving of a certain quantity of gas; but they did not act satisfactorily. The plaintiffs agreed to make a number of tests; but the defendants said this had not been done. Eventually they wrote instructing the plaintiffs to take the governors away. The plaintiffs thereupon sued for £25, their value. Frank Gathers, in the service of the plaintiffs, said he went to the defendants' premises to test one of the meters, and was told it was defective. A few days later he called to test the second meter, but was not allowed to do so. He subsequently admitted that he had made appointments with defendants which he had not kept. On this statement being made, the plaintiffs decided not to proceed further with the case. Judgment was accordingly given for the defendants, with costs.

Improperly Using Gas.—At the West Ham Police Court last Wednesday, Jessie Cockley, a married woman, was summoned for improperly using and burning gas, the property of the Gaslight and Coke Company. On May 10 a collector called and found the gas-meter in good order; but on July 12 he saw that the lock had been forced, and defendant said her husband had taken out the money. A warning was given; and the collector put the lock in order. In consequence of a note received, another collector called on Sept. 22, but found that defendant had gone, leaving no address. Inquiries were made; and after a good deal of trouble she was traced, and admitted having used the gas. The value of the amount used was 12s. 9d. It was pointed out that defendant was liable to a fine of £5 for the offence, and 40s. for each day it was repeated. A fine of 20s. was imposed, or fourteen days' imprisonment.

How Windsor Cuts Down Management Expenses.—The following recommendations of the Joint Water and Health Committees have been unanimously adopted by the Windsor Town Council: "(1) That Mr. Smith be engaged as Engineer at the water-works under the direct control of the Water-Works Committee for a period of six weeks as a trial; and that for his extra services he should have the house rent, rates, and taxes free, light and coal, and a piece of the garden at the rear. That the wages payable to him shall be £2 2s. per week during the period of his engagement. (2) That the Borough Surveyor be empowered to carry out all the duties of the Manager other than those performed by Mr. Smith, for a similar period of six weeks, without further emoluments. (3) That at the expiration of such period of six weeks, a report on the working of the water-works be submitted to the Water-Works Committee for their consideration."

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Unfair Competition of Electricity.

The Half-Yearly Meeting of this Company was held at the Offices, D'Olier Street, Dublin, on the 30th ult.—Alderman W. F. COTTON, M.P., D.L., in the chair.

The SECRETARY AND MANAGER (Mr. F. T. Cotton) having read the notice convening the meeting, the report, the principal figures in which were given in the "JOURNAL" a fortnight ago, with the accounts for the six months ended the 30th of June, was presented.

The CHAIRMAN, in moving the adoption of the report, said there had been a slight falling-off in the revenue from gas, and also in meter-rents. This, in a large measure, was to be accounted for by the long bright days during the months of May and June, competition with the electric light, and the great improvement made in incandescent gas lighting, especially where inverted burners were in use; a much larger amount of light being obtained for a considerably smaller consumption of gas. It had been reported that a new lamp had been introduced recently which gave 42-candle power for a cubic foot of gas. No doubt it would be within the recollection of the shareholders that, on the last occasion on which he had the honour of addressing them, he intimated that the Directors had formed a suspense account for the purpose of writing-off from time to time the expenditure incurred in remodelling the retort-houses at No. 2 station in Great Brunswick Street. On that occasion, it was resolved to commence by writing-off out of revenue £4000 from the amount expended on these retort-houses, &c., which came to £32,000. The Directors now proposed, subject to confirmation, that £5000 should be written-off the present revenue for a similar purpose. He ought to mention that these retort-houses, with due care and repairs, would stand work for the next forty or fifty years. He was glad to be in a position to state that these houses, and the apparatus connected therewith, were now yielding splendid results both in gas and coke. The Company were making coke which was of far greater value to the public than that produced under the old system. It was not friable, and therefore could be stored at a minimum loss. During the six months under review, there had been 6314 additional tons of coal carbonized compared with the corresponding period of 1910. This item would account for the increased expenditure of £3814 under that head. On the other hand, there had been a decreased outlay of £5875 for oil. Having dealt with coal and oil, the Chairman directed the shareholders' attention to the other items of expenditure, to which there were several additions. Passing on to give an account of some of the Company's working transactions during the half year, he said they included the putting-in of 1872 new installations. The heating-stoves let on hire numbered 1757, and the fires 2826—making a gross total of 43,843 cookers and heating appliances in use at the end of the half year. The large number of cookers supplied showed plainly that gas was beginning to be appreciated as a fuel by the public, not only for its convenience, but also for its cleanliness and economy. In conclusion, he desired to make a few remarks with reference to the supply of electricity for street lighting. While the Corporation of Dublin were contemplating the erection of additional electric lamps, other local authorities were abandoning electricity and returning to gas. The whole of Whitehall—indeed, he might say all the thoroughfares between Whitehall and Euston, were now lighted with gas, the electric lamps having been abandoned some twelve months since. From observation he must say that in all his experience he had never seen more beautiful street lighting; and it had been carried out at great saving to the local authorities concerned. He might direct attention to the gas-lamp erected recently by the Company opposite the Dublin United Tramway Company's offices in Upper Sackville Street, which was giving as much light as, if not more than, the two electric lamps which stood near it—one on either side. It could be supplied at the low cost of £9 10s. per annum, whereas the Corporation charged the Public Lighting Department £40 per annum for the two lamps referred to, and at the rate of £20 per annum for the other arc lamps in the city. These excessive charges also applied to some of the municipal offices and the bridges. The bridges were formerly lighted with gas; but the Corporation discontinued this lighting on the O'Connell Bridge, and other bridges—it being stated at the time that it was done for economy's sake. But immediately the Corporation started their own lighting, all the bridges were lighted by electricity—the economy being lost sight of. Was it any wonder that, under these circumstances, the public lighting of the city, which formerly was done for about £10,500 per annum, now cost £23,000? This was due to the method adopted by local authorities who were suppliers of electric light. He might mention that the Corporation had already taken more than £60,000 from the rates in order to make up the deficiency incurred on the electric lighting of the city. He considered he was justified in stating that every effort had been made by that body to depreciate gas lighting in the public mind. The gas-lamps were extinguished at most unearthly hours in the morning; and hence the working classes had really to grope their way through the dark to get to their employment on winter mornings where gas-lamps were used.

The DEPUTY-CHAIRMAN (Mr. John Murphy) seconded the motion.

Mr. MAGUIRE, in supporting the motion, remarked that the competition in the matter of electric lighting in Dublin was not a commercial one, but one subsidized out of the rates. He agreed with the Chairman, that in other places electric lighting was being superseded, on account of being too expensive, by gas lighting. The attempt of the Dublin Corporation to continue the electric lighting of the city was intelligible; but at the same time it was lamentable that the ratepayers had to pay for it. The losses in working would increase each year; and he should not be surprised, if the present state of things continued, to find that the ratepayers in future would be paying half-a-crown extra in rates on account of this foolish undertaking.

The motion was carried unanimously, and a dividend at the rate of 5 per cent. per annum, as recommended in the report, declared.

A vote of thanks having been accorded to the Directors, officials, and staff,

The CHAIRMAN, replying on behalf of the Directors, said they had left nothing undone which would conduce to economy. All the machinery which they had erected had this object in view, and would, they expected, bring about the desired effect. Still more gratifying was the fact that they intended to pay out of revenue the cost of erecting the machinery, and not charge it to capital.

Mr. F. T. COTTON also acknowledged the vote on behalf of the staff.

The proceedings then terminated.

EXHIBITION OF GAS APPLIANCES IN ABERDEEN.

On Friday afternoon, an exhibition of gas appliances, of more than usual merit—claimed, indeed, by some who are competent to form the opinion that it is the best exhibition exclusively confined to gas which has yet been held in Scotland—was opened in the Olympia Skating Rink, Aberdeen, and will be open daily till Saturday, the 21st inst. The exhibition has been promoted by the Corporation of Aberdeen, with a view to benefiting the Gas Department. It is pleasing to note that one of the main reasons why the exhibition is being held is the large amount of business that accrued from an exhibition, on a smaller scale, which took place in the city five-and-a-half years ago. It is felt that the present is an opportune time for the holding of an exhibition, because of the great advance which there has been since then in gas appliances generally; and of the recent resolution of the Town Council to abolish rents for gas cooking appliances.

The skating rink has been befittingly decorated, equipped with stands of appropriate design, and brilliantly lighted. The special lighting arrangements consist of four "Nonpareil" gas-lamps, by Messrs. James Milne and Son, each containing a cluster of thirty inverted incandescent gas-burners, and consuming about 80 cubic feet of gas per hour; and four high-pressure gas-lamps of 1500-candle power each, provided by the James Keith and Blackman Company, who have also, on the order of the Public Lighting Committee of the Town Council, fitted up eight high-power lamps outside the building. One end of the big hall is largely occupied by the exhibit of the Corporation of Aberdeen, which is unmistakably the principal show in the place. It consists of a suite of rooms—a dining-room, bedroom, kitchen, scullery, and bath-room—which are served exclusively by gas. In the kitchen, there is a cooker and circulator, in the scullery a wash-boiler, and in the bath-room a geyser, radiator, and gas-heated towel-rail. As an object-lesson on how much service can be got out of gas in a dwelling-house, it is impossible to conceive of anything more convincing than this exhibit, the arrangement and equipment of which have been specially looked after by Mr. S. Milne, the Corporation Gas Engineer, who has also, of necessity, had the oversight and directions of all the preparations for the exhibition. There are only two local exhibitors.

On entering the hall, there is, on the left-hand side, a stall belonging to Messrs. Alder and Mackay, who exhibit a variety of gauges, meters, and an interesting automatic lighting and extinguishing system. Messrs. Ewart and Sons give a display of geysers in operation; and adjoining is a stall by the Richmond Gas Stove and Meter Company, who, in addition to cooking, lighting, and heating appliances, have a fully-equipped greenhouse, full of flowers growing under a gas heating system. Messrs. R. & A. Main show a large assortment of gas-fires; and Messrs. John Wright and Co. exhibit a series of ornamental fire-places, several of them lent by Messrs. James Bannochie and Sons, of Aberdeen. At the end of the hall, there is a stall by Messrs. Fletcher, Russell, and Co., where the special feature of interest is a laboratory, workshop, and general industrial purpose appliances. Proceeding along the other side of the hall, the visitor sees an interesting exhibition of hot-water circulators and fire-places shown by the Davis Gas-Stove Company; and further along is a series of exhibits by the Parkinson Stove Company, who make a feature of the Maughan patent gas-geysers. The Carron Company have an abundant display of their well-known stoves and grates. The James Keith and Blackman Company show a system of high-pressure gas lighting; and Messrs. Crossley Bros. have on view and in operation a 15½ B.H.P. engine. The centre area of the hall is occupied by three island stands, of firms manufacturing gas fittings, brackets, pendants, burners, and glass ware—the display being very attractive. The firms represented are Messrs. G. Hands and Co.; Mr. John S. Pirie, of Aberdeen (who has an exceedingly attractive stall, full of appliances in modern use); Clark's Syphon Stove Company, Messrs. George Bray and Co., Mr. A. M'Robb, of Aberdeen, Messrs. J. & W. B. Smith, and Messrs. Falk, Stadelmann, and Co. Mrs. Dunn, of Newcastle, has been engaged to give instructions to visitors as to the use of the different appliances; and she will also give demonstrations of cookery in paper bags.

The opening ceremony was performed by Lord Provost Wilson.

Mr. J. A. Sangster, the Convener of the Gas Committee of the Town Council, presided over a large gathering of citizens. He gave a brief history of the gas undertaking in Aberdeen. In 1824, he said, the gas cost 50s. per 1000 cubic feet; later it was reduced to 40s. Progress having been made in the manufacture of gas, the Company decided to change their method, and were able to supply gas at 15s. per 1000 cubic feet. After this, it was reduced to 9s. In 1872, the price was further reduced to 5s., and last year it was 2s. 6d. per 1000 cubic feet. For the current year, the price was reduced to ordinary consumers from 2s. 6d. to 2s. 3d; and this compared favourably with Glasgow 2s., and Edinburgh and Leith 2s. 8d.

Lord Provost Wilson confined his remarks to the question of cookery. Preparing and softening food by the action of fire, and so rendering it fit for digestion, was, he said, perhaps one of the chief factors towards human happiness and contentment. The time was not far distant when the poorest man could have his cooker; and this was the object of the Corporation in promoting the exhibition.

Several votes of thanks were accorded; among them being one to Mr. Milne, for his part in making arrangements for the exhibition.

NEW GAS-WORKS AT TITCHFIELD.

Opening Ceremony.

The new gas-works which have been erected to the design of Mr. H. King Hiller, of No. 9, Victoria Street, Westminster, and supervised by the Works Manager (Mr. A. E. Whitcher) were opened at Titchfield on Monday last week.

The parish of Titchfield, which is situated nearly midway between Portsmouth and Southampton, has a population of about 5400; and until the new works were brought into use, it had been served by plant erected in 1865 by the Titchfield Gas Company. At the end of last year, the works were purchased by Mr. W. A. Schultz and some of his friends; and a new Company was registered under the title of the Titchfield and District Lighting Company, Limited. Immediate steps were taken to rebuild the plant; and at the present time the Company have compact new works capable of producing 10 million cubic feet of gas per annum, and of extension, at small additional cost, to upwards of 14 millions per annum.

The new works consist of a steel-framed retort-house 25 ft. by 25 ft. and 18 feet high; the panels being filled in with 4½-inch brickwork, and the roof covered with corrugated iron sheets. In the house are two beds of full-depth regenerator settings of six and five retorts respectively; the setting of six being divided by a midfeather wall into two settings of threes. The retorts are Ω-shaped, 21 in. by 15 in. and 10 feet long.

The contract for the foregoing, as also for an elevated cast-iron water-tank on a steel-framed tower, was entrusted to Messrs. Gibbons Bros., Limited, of Dudley. A "Reflux" condenser-washer and an acid washer have been supplied and erected by the Chemical Engineering Company; a gas-engine, exhauster, and pumps by the Bryan Donkin Company, Limited; purifiers, works connections, and a two-lift spiral-guided holder, of 30,000 cubic feet capacity, by Messrs. C. & W. Walker; and a station meter and governor by Messrs. Parkinson and W. & B. Cowan. The total cost of the new plant, including extra land and engineering charges, has been less than £3000.

After an introductory speech by the Chairman, the opening ceremony was performed, in the presence of the Directors and a number of invited guests, by Mrs. W. A. Schultz, who, with a silver-gilt key suitably inscribed, presented by the Contractors and staff, opened the engine-room door and started the exhauster. Among those present were the Chairman and members of the Titchfield Lighting Committee, Mr. J. D. Ashworth, Engineer of the Portsea Island Gas Company, Mr. A. E. Brooks, Engineer of the Ascot District Gas and Electricity Company, Mr. H. W. Falkner, Manager of the Sandown Gas-Works, representatives of the Contractors, and many others.

After the visitors had been conducted round the works by the Engineer, light refreshments were served, and with hearty wishes for the success of the undertaking the company dispersed.

MISHAP AT THE SOUTH SHIELDS GAS-WORKS.

Shortly after eight o'clock on Monday evening last week, the gas consumers in the lower part of South Shields were alarmed to find their lights gradually diminishing, and in some cases eventually being extinguished entirely—the trouble continuing for about half-an-hour. The higher parts of the town and the other districts supplied by the South Shields Gas Company were not affected at all, nor were the lights at the gas-works; so that the foreman had no knowledge of anything being wrong until complaints arrived. We learn that the trouble was caused by the water-loaded station governor supplying the affected area having had its water run-off cock opened, which resulted in the governor almost closing; and notwithstanding the fact that all the distributing mains supplied by other station governors, at both the Shields and the Jarrow works of the Company, are interconnected in the district, the trouble resulted to the "tail-end" of the lowest district. All the station governors had been set during the afternoon to the required evening pressure (38-10ths); and the night foreman, who came on duty at 5 p.m., had no adjustment whatever to make from that time until nearly midnight. How the water run-off cock came to be opened is a mystery, though at present the facts point to this having been done wilfully by some unauthorized person. The foreman was in the governor-house several times between 5 and 8 p.m., and on each occasion everything appeared to be in order.

CHARLOTTENBURG GAS UNDERTAKING.

The report of the Corporation Gas-Works of Charlottenburg for the year 1910 records a great increase in the sales of gas, and increased profits. The gas sold amounted to 55,232,170 cubic metres (195,055,000 cubic feet), which is an increase of 9 per cent. on the quantity sold in the previous year. The increases in 1908 and 1909 were at the rate of 6·04 and 3·05 per cent. The population in the district supplied has increased by 5·5 per cent. in the year. The use of gas for cooking and heating purposes has been encouraged by the gas department having, since the year 1892, undertaken to let on hire and sell gas cooking and heating stoves. The average receipts per 1000 cubic feet of gas sold through prepayment meters are actually rather less than the uniform price of 3s. 8d., which is charged to other consumers. Having regard to the smaller consumption per meter, the frequent change of abode of prepayment meter consumers, and the generally increased expenses involved, it is evident that this class of business at the present tariff does not pay so well as the rest. But from the social and hygienic standpoint, it is considered desirable to encourage the use of gas in the smallest households, and consequently the administration of the gas undertaking does not propose to increase the price of gas to this class of consumer. The coal carbonized yielded 10,844 cubic feet of gas per ton; and the coke consumed in heating the settings amounted to 14·63 per cent. by weight of the coal carbonized. In the manufacture

of water gas there were consumed 39·68 lbs. of coke in the generators; 15·62 lbs. of coke, breeze, and pan coke in the boilers; and 4·44 lbs. of gas oil, per 1000 cubic feet of gas made. The proportion of water gas made was about 10 per cent. of the total. Of the coal carbonized, 73·6 per cent. was English. The number of public lamps on March 31 last was 6545, comprising 7782 burners. Included in these are 184 high-pressure gas-lamps with two burners, and 13 low-pressure high-power lamps with three burners. The high-pressure gas-mains on the 1st of April last had a length of 6144½ yards. The total length of distributing mains at the close of the year was about 176 miles. The net profit realized on the year's working was 2,584,817 marks (£126,700), which represents a return of 14·19 per cent. on the capital invested in the works. This profit not only far exceeds the estimate made at the beginning of the year, but is much greater than in any preceding year.

EXTENDED USE OF GLOVER-WEST VERTICAL RETORTS.

Installations for Belfast and Nelson.

It was mentioned in the "JOURNAL" for the 26th ult. that the Gas Committee of the Belfast Corporation had decided, on the recommendation of a Sub-Committee and the Gas Engineer (Mr. J. D. Smith), to introduce the Glover-West system of vertical retorts, and to accept the tender of West's Gas Improvement Company, Limited, for an installation capable of producing 2½ million cubic feet of gas per 24 hours. The matter came before the County Borough Council on Monday last week, in the minutes presented by the Gas Committee. They dealt at some length with the investigations of the deputation appointed to visit different works in England and Scotland, in order to examine the various systems of vertical retorts, and to inspect large spiral-guided gasholders. Alderman Craig, in moving their adoption, said he wished to call attention to the report of the deputation. They went into the subject in a very thorough manner, having visited a number of towns in order to see the various plants at work; and they were unanimously of the opinion that the continuous system of carbonization was likely to give them the best results in Belfast. While in England, they also took the opportunity of inspecting a large spiral-guided gasholder, in order to see for themselves the construction and advantages of this class of holder; and they were greatly pleased with, and impressed by, what they saw. After the deputation returned, tenders were invited by the Committee from all the makers of vertical retorts, and these firms were asked to quote on a specification prepared by the Engineer. The tenders, with the accompanying plans, were minutely examined and compared; and the Committee came to the conclusion that the offer of West's Gas Improvement Company was the most advantageous for the Corporation. The tender was for a complete installation of vertical retorts, capable of producing 2½ million cubic feet of gas per 24 hours. They anticipated that the results from the plant would be of a very satisfactory character. The minutes were passed.

Some months ago, the Gas Engineer and Manager of the Nelson Corporation (Mr. A. Morton Fyffe) was instructed to visit gas-works, and report fully on methods of carbonization. The matter was also considered by a Sub-Committee. The result of their combined investigations was an unhesitating recommendation to the Gas Committee that an installation of Glover-West vertical retorts, capable of carbonizing 110 tons of coal per 24 hours, should be erected. The reason for this decision was the immediate necessity of providing carbonizing plant to meet the growing gas consumption; and the Sub-Committee came to the conclusion that the scheme they presented would increase the productive capacity of the plant by 24 per cent. without lowering the annual revenue. Moreover, the new system of manufacture would, they said, ensure a purer atmosphere in the centre of the town, while the conditions of labour would be far superior to those obtaining with any other system of carbonization. It was pointed out that the absence of intricate machinery would render wear and tear and renewals inexpensive; that the present retorts could be allowed to remain until the new installation was completed, thus obviating risk of interference with the continuous supply of gas; that the old retort-house could be retained as a coal-store, thereby saving the extension of the existing store; and that with vertical retorts the quantity of naphthalene in the gas would be reduced to a minimum. The Sub-Committee suggested that all the members of the Gas Committee should visit St. Helens to inspect the installation of Glover-West vertical retorts in operation there. They submitted that the Committee should recommend the Council to sanction the erection of an installation of similar retorts at Nelson; accept the offer of West's Gas Improvement Company, Limited, for the work, including coal and coke handling plant; that borrowing powers for £21,650 for the purposes of the installation be applied for forthwith; that the Gas Engineer should obtain tenders for the necessary foundations and other works; and that the contracts should be placed without delay, so that the work might be put in hand to ensure completion before the winter of 1912. These recommendations came before the Town Council at their meeting last Wednesday, and were adopted. It was also decided to apply to the Local Government Board to sanction the borrowing of the above-named amount.

Preston Corporation Water Undertaking.—Dealing with the water-works undertaking in his annual abstract of accounts, the Borough Treasurer of Preston points out that the debit balance has been increased by £4208; bringing up the total to £24,172. The income for the year was £33,387, including £16,435 from water-rates, £15,444 from sales by meter, and £1034 from meter-rents; the remainder being from rents on property, profits on fittings and materials, &c. The working expenses totalled £10,382—leaving a balance of £23,005 to meet the payment of interest and sinking fund on a capital of £27,215. During the twelve months, further capital expenditure of £11,623 was incurred, increasing to £636,027 the amount laid out. The liability for loans on water-works account now stands at £471,047, in addition to a debt of £32,016 to the bankers of the Corporation.

BRIDGWATER GAS COMPANY.

Bonus and Pension Schemes for the Employees.

At the Annual General Meeting of the Bridgwater Gas Company on the 29th ult., the Directors reported that the balance of net profit for the year amounted to £4012, which added to the amount brought forward and the interest from bankers made a total of £5522. Interim dividends at the rate of 10 per cent. per annum on the "A" stock and 5 per cent. per annum on the "B" and "C" stocks had been paid for the first six months of the year, amounting to £1625; and there was a balance of £3635 to be dealt with. The Directors recommended the payment of final dividends of 5 per cent. on the "A" stock, and 2½ per cent. on the "B" and "C" stocks. These would absorb £1625, and leave a balance of £2010, out of which it was proposed to carry £487 to the reserve fund, £250 to the insurance fund, and the balance of £1273 to the credit of next year's accounts. The sales of gas amounted to 80,106,700 cubic feet; showing the satisfactory increase of 2,464,500 cubic feet over the sales of the preceding year.

The CHAIRMAN (Mr. R. Y. Foley), in moving the adoption of the report and accounts, referred to the continuing expansion of the Company's business, which necessitated considerable extensions to their manufacturing plant. The Directors contemplated the erection of a new retort-house, with modern and up-to-date plant; and, with this end in view, one of the gasholders had been moved. Following in the lines of many other industrial undertakings, the Directors had instituted a bonus scheme among their employees, whereby every person in their service would, in time, become a stockholder in the Company. To this had been added a pension scheme for the workpeople, the cost of which was being borne by the Company. These institutions must be of the greatest benefit to the employees, and would also benefit the Company in many ways.

The report was adopted, and it was resolved to pay the dividends recommended.

The CHAIRMAN, in proposing the reappointment of Mr. J. H. Cornish as Secretary and Manager, referred to the ever-increasing work devolving upon him and the staff by the extending business of the Company. The alterations also involved an immense amount of extra work in the preparation of drawings, specifications, and estimates. All these had been done by Mr. Cornish, and the work would be carried out and superintended without any additional cost to the Company. He moved that the best thanks of the stockholders be given to Mr. Cornish and the staff under him for their faithful services.

The motion was carried; and Mr. CORNISH returned thanks on behalf of himself and the other members of the staff.

A cordial vote of thanks to the Chairman and Directors for their successful conduct of the Company's business during the past year brought the proceedings to a close.

BIRMINGHAM CORPORATION GAS UNDERTAKING.

Land for New Works.

At the Meeting of the Birmingham City Council next Tuesday, the Gas Committee will present a report on a proposed site for new gas-works. In the course of it, they state as follows.

It will be remembered that on Nov. 9, 1901, the Council authorized the Committee to purchase 108 acres of land at Birches Green, Erdington, with a view to erecting gas-works thereon; but, owing to the opposition offered to the scheme, the sanction of Parliament was withheld. The Birmingham Extension Order provides that no works for the manufacture or storage of gas should be constructed or carried on by the Corporation within any part of the parish of Erdington. This clause was inserted to carry out a promise which was made to the Erdington Council when their opposition to the extension scheme was withdrawn.

The Council recognized as long ago as 1901 the necessity for acquiring extra land for the purpose of gas-works extensions. At that time the annual consumption of gas was 5709 million cubic feet, whereas last year it was no less than 7693 million cubic feet—representing an increase in the ten years of nearly 50 per cent. The gas consumed in the area supplied from the several works of the department has increased from 2327 million cubic feet in 1875 to the above-named quantity in 1911, or no less than 5366 million cubic feet over the period mentioned.

Having regard to the fact that the Birches Green site may not be used for gas-works purposes, it became necessary to make inquiries respecting other possible sites. Of several inspected, the most suitable is a piece of land at Washwood Heath, belonging to the Drainage Board, which can be connected by sidings with the Midland and the London and North-Western Railways. The Committee have been in negotiation with the Board for the acquisition of the land, which contains about 37 acres, and adjoins the Saltley works of the Board. The land lies between the Birmingham and Derby line of the Midland Railway Company and the River Rea, and is at present used for allotment purposes. This arrangement it is proposed to continue until the land is required for the gas undertaking.

Any purchase would have to be subject to the Corporation obtaining parliamentary powers to acquire the lands and utilize them for the erection of gas-works; and if the required consents are not obtained within three years, either party will be at liberty to cancel the arrangement. If a Bill is to be promoted for tramway purposes, the present appears to be a good opportunity for obtaining the necessary powers. The Committee therefore recommend that authority be sought to enable the Drainage Board to sell, and the Corporation to purchase and use, the lands above mentioned for gas-works purposes; and that, subject to such powers being obtained, the Committee be authorized to purchase them from the Board at a price to be agreed.

Messrs. James Milne and Son, Limited, have appointed as their representative for the South of England Mr. R. V. Steed, formerly with Messrs. Willey and Co., of Exeter.

MANCHESTER CORPORATION AND GAS-FIRES.

Futile Protest by Ironmongers and Plumbers.

At the Meeting of the Manchester City Council last Wednesday, further reference was made to the decision of the Gas Committee to supply and fix gas-fires, and "other gas-consuming devices," for the consumers of gas within their area.

It was Alderman Wilson who brought the matter forward, when the minutes of the Gas Committee were submitted for confirmation. He alleged that the Committee had given but scant attention to the protest made by the Associations whose members were seriously affected by this further extension of municipal trading—namely, the Ironmongers' Federated Association, the Manchester and District Ironmongers' Association, and the Manchester and District Master Plumbers' Association. In the epitome of the Committee's proceedings, it was stated that the communications had been "read and ordered to be entered on the minutes." Alderman Wilson asked if this was all that was to be said on this important matter. Private traders were large ratepayers in the city; and if the policy of the Gas Committee was to be carried out, those engaged in the ironmongery and plumbing trades were to be robbed by the Corporation of a portion of their trade. Members of the Ironmongers' and Plumbers' Associations were protesting against the Gas Department undertaking the supply of gas-fires and heaters; and they were entitled to do so all the more because they knew that the Gas Committee had resorted to boy labour, thereby depriving men of employment. Moreover, the charges for alterations were too low. Alderman Wilson concluded his speech by moving that the matter be referred back to the Committee for further consideration.

Mr. Ross Clyne, who seconded the resolution, argued that it was wrong to take away the means of livelihood from people who paid rates and taxes. This new departure on the part of the Gas Committee would certainly seriously injure individual traders, and on this ground he hoped the Council would support the amendment.

It was pointed out by Mr. J. Billam that the Council had approved of the Gas Committee's proposal, and that the only point at issue was their treatment of the resolutions of protest sent by the Associations affected.

The Deputy-Chairman of the Gas Committee (Mr. Kay), in his reply, denied that boy labour was used, and explained that the charge of 3s. was a minimum one. This scheme, he added, was not entered upon without proper inquiry; and now that the sanction of the Council had been obtained, the Committee were determined to go on. Certain fields of illumination were being closed to them; and this new department had been decided upon to provide scope for the employment of their capital, as well as for other reasons which he need not elaborate.

The minutes were confirmed as submitted.

THE PRICE OF GAS AT ROCHDALE.

An Argument in Favour of a Further Reduction.

The Rochdale Town Council, at last Thursday's meeting, approved of the recommendation of the Gas Committee for a reduction in the price of gas for lighting purposes by 2d. per 1000 cubic feet to ordinary consumers, and increasing the quantity supplied through slot-meters from 25 to 27 cubic feet for 1d.

Mr. Walker, the Chairman of the Gas Committee, explained that the concession to the consumers by automatic meter amounted to nearly 3d. per 1000 cubic feet; while the concessions as a whole represented to the department a matter of about £3200 per annum. Referring to suggestions which had been made that there should have been a larger reduction in price, he said his Committee considered the reduction agreed upon a reasonable one, having regard to the gradual increase in the cost of manufacture, wages, and material.

Mr. Mattley argued that the reduction in price was not large enough, and advanced a number of reasons to support his contention. It was due, he said, to their able Manager (Mr. T. B. Ball), and the watchfulness of the Committee, that the undertaking stood in a better position than it had since it was taken over from the Commissioners in 1844. The production was increasing; and, as far as he could make out, they had reached the end of extraordinary expenditure. Looking at the accounts for the past year, he found that the gross profits were £29,000, and that, after the payment of interest and sinking fund charges, there was a net profit of £17,000, of which £12,000 was handed over in aid of the rates. The Chairman had told them that the proposed reduction in price would mean a loss in revenue of £3200 a year; but he desired to point out that the Committee were paying £1419 in income-tax. He considered it unfair that this sum should be paid as income-tax while gas consumers should only have relief to the extent of £3200. What it meant was, 2d. to the ratepayers and 1d. to the Income-Tax Commissioners, which seemed to him an unsound way of conducting business. The Gas Committee should take into consideration the question of equalizing the price of gas both for lighting and heating purposes, in order to induce more people to use gas-cookers, and so help to mitigate the smoke nuisance, besides bringing about a lessened waste in coal consumption. The Manchester Corporation, he pointed out, supplied gas-cookers free, and why not Rochdale? He understood that one of the chief drawbacks to the greater use of gas-stoves in Rochdale was the charge made by plumbers for fixing the stoves. This was a matter that ought to receive the attention of the Gas Committee. With a further reduction in price, there would be a larger consumption; and he reminded the Committee that it was now recognized that the making of large profits on municipal undertakings for rate-aid was absolutely bad.

No amendment was proposed, and, as stated, the Gas Committee's recommendations were confirmed.

Since the Council meeting, an explanation has been furnished in regard to the payment of the £1419 for income-tax. The Corporation are liable for income-tax on the interest payable on the total debt of the borough. The interest payable on borrowed money in respect of the Gas Department amounts to £7300. The tax on this sum is, roughly, £425 a year (and is included in the £1419), which, of course, would have to be paid whether there was a profit or not. This would leave a balance of £1000, in round figures, chargeable on the profits of the undertaking; but as the Corporation are assessable on the total amount of interest payable on the debt of the borough, they are allowed to set off this £1000 against the total charge. The amount is actually deducted from the total tax due by the Corporation on their mortgage interest. Therefore, a further reduction in the price of gas would mean no relief to the Corporation so far as income-tax is concerned.

PUBLIC LIGHTING OF ASHFORD, MIDDLESEX.

Inhabitants Persistently Prefer Darkness.

A correspondent sends the following remarks on the above-named subject: Ashford in Middlesex is an important town, owing to its close proximity to the Metropolis. In fact, it bids fair to become in a short time a mere appanage or suburb of ever-growing London. It can boast of many things—viz., that it has a population of 5000, that it is only 17½ miles from one of the busiest termini in the heart of the Empire, that it has no less than 27 trains running to town every day, and that it is fast becoming one of the "sleeping-places" of the City, as can be seen by the crowded state of the up platform when the 7·55 a.m. train comes in. But one important matter it cannot boast about—and that is its persistency in refusing to adopt the Lighting and Watching Act of 1833. It seems hardly possible, in these days of increasing light in our public places, that Ashford should have refused to have its 14 miles of roads lighted by gas after nightfall; but this is the case. Five polls of the inhabitants had declared for darkness; but the Council now being unanimous for light, there was hope that gloom might be dispelled, and that during the coming winter City people on arriving at Ashford Station each evening might find the way to their homes with some degree of comfort. But the parish meeting held to consider the matter was not unanimous. Nine persons who were present "love darkness rather than light;" and owing to their adverse vote the Council's decisions were of no avail. Last Saturday the inhabitants were put to the expense and trouble of a poll to settle the question. To enable the Council to proceed, 617 people must record their votes; and of this number 410 must be in favour. At the parish meeting last year, 50 persons voted for darkness; and although last Saturday 326 were for and only 25 against the proposal, the poll was declared void because the necessary number had not voted in favour.

STREET LIGHTING AT LEWES.

A recommendation of the Highways and Works Committee, that the tender of the local Electricity Company for the lighting of 127 street-lamps should be accepted, and that notice be given to the Gas Company to terminate the existing arrangements in respect to these lamps, gave rise to a long debate at last Wednesday's meeting of the Lewes Town Council. The question had been before the Council on a previous occasion, when it was referred back to the Committee.

At the outset, Mr. Fowler asked for a ruling on the point whether members interested in the Gas Company would be allowed to take part in the discussion or to vote. The Mayor (Alderman Holman) said he believed it was optional for such members to speak; but they would not be able to vote on the question. After a consultation with the Town Clerk, however, he stated that in the opinion of that gentleman members interested in the Gas Company were disqualified from speaking as well as voting; and he must rule accordingly.

The first speaker was Mr. Verral, who remarked that he had intended to move an amendment to the motion for the adoption of the Committee's report; but he could not find anybody to second it. He did not consider the Gas Company had been treated fairly. Then Alderman Flint said he considered gas to be far preferable to electricity for street lighting. There had been no demand from the inhabitants for an alteration in the system of illumination. They knew of several places where the electric light was not satisfactory; and only a few days ago he was reading of such a state of things at Worthing. Other towns in which electricity had been adopted for public lighting were having gas re-instated. If the Council intended to give the contract for 127 lamps in the main streets to the Electric Light Company, did they expect the Gas Company to light the remaining 167 lamps at the rate they were charging now? When the price of gas was reduced to private consumers, the Council received the benefit, notwithstanding the agreement which specified a higher price. They had a very good light from the incandescent gas-lamps; and he thought the Council would find that there would be no saving whatever if electricity were adopted. He believed they would be studying the interests of the ratepayers if they continued incandescent gas for street lighting. Alderman Wightman also said they were there to study the interests of the ratepayers, and also to act justly towards all parties. Personally, he did not consider it would be fair to ask the Gas Company to supply light to the back-streets, and take away from them the main thoroughfares. Before entering into a fresh contract, the Council should have served the Company with six months' notice to terminate the existing agreement. This would have given the Company an opportunity of submitting a price—possibly a reduced price—for lighting the whole town.

On the other hand, Mr. Patrick said the persons he had spoken to on the subject had all, without exception, expressed a preference for electric lighting. In places exposed to high winds, at any rate, electricity had a great advantage over gas; and the figures showed that by adopting electric lighting there would be a considerable monetary saving. What did it matter to the Gas Company whether they supplied gas in the back-streets or the main thoroughfares? Next Mr. Lloyd, while agreeing that gas was the better illuminant, said he was going to vote

for electricity because it would effect a bit of a saving. Alderman Every maintained that they had not treated the Gas Company fairly; and Mr. Fowler wound up the discussion by stating that he would vote for electricity, because it would be beneficial to the ratepayers. The rates were high enough, and would be higher still; and if the Council could save upwards of £50, it would help keep the rates down.

The motion for the adoption of the report was then put and carried, fourteen voting for it and seven against.

ELECTRIC LIGHTING AT WORTHING.

Dissatisfaction in the Town Council.

At the Meeting of the Worthing Town Council on Monday last week, considerable discussion took place on the subject of the electric lighting of the town. First of all, the Highways and Works Committee expressed their dissatisfaction with the lighting, especially in respect of its "uncertainty and irregularity." Then the Sanitary Committee said residents near the generating station had complained of the nuisance caused by the black smoke issuing from the chimney. With regard to the first matter, the Resident Engineer admitted that the defective condition of many of the arc lighting cables had seriously affected the burning of the lamps in the main streets of the town; but he said the renewal of the cables would enable the public supply to be efficiently carried out.

A discussion then ensued on the subject of the electric light and its shortcomings. Mr. Tree declared that for some time past the lighting of the town had been disgraceful; and unless something was done, it was a question whether they would not have to revert to gas. Mr. Gardiner alluded to the continual complaints; but he admitted that figures which had been supplied to him showed things were not so bad as he had thought them to be. The average illuminating power of the electric lamps totalled 124,000 candles, and the amount charged for public lighting (including maintenance) for the last financial year was £3116. The gas consumption for public lighting averaged 64,300-candle power, and the cost was £1925. Mr. Cook remarked that these figures did not controvert a statement he had made, that they could get light from gas equal to that which they obtained from the arc lamps with a saving of £2000 or £3000 a year. Every flame arc lamp cost £34 a year. Alderman Linfield said the unfortunate thing was that the town was not obtaining the light it should do. If the lamps were giving the light they were supposed to yield, there would be nothing to grumble about. He was glad to learn that, light for light, they were getting their electricity cheaper than gas. But by now the concern ought to have been brought into working order; and the lamps should not be continually going out. There was no question, Mr. Ellis declared, that gas gave a more regular and constant light than electricity, and worked out cheaper. Mr. G. Gravett complained of the very unsatisfactory way in which the town was lighted by electricity. Alderman White reminded the critics that Worthing had spent from £50,000 to £80,000 on the electricity undertaking, and that repayment of the loans would go on whether or not the town was lighted by electricity. While agreeing that the Council would never have undertaken the supply of electricity had they known what the cost was going to be, Alderman Piper urged that their present duty was to make the best possible out of it. After some further remarks, the Chairman of the Electricity Committee (Alderman Walter) dealt with the various points raised in the discussion, and the subject dropped.

HYTHE AND SANDGATE GAS COMPANY.

At the Annual General Meeting of this Company, on the 29th ult., the Directors reported that the improvement shown in the position and prospects of the Company by the previous annual statement of accounts had not only been well maintained, but very materially increased during the year ended the 30th of June last. The gross profits for the year amounted to £1578, against a profit of £1141 in the previous year, and a loss of £55 in 1909. In the previous report, the Directors referred to the arrangements made with the British Coalite Company, and expressed the hope that the Hythe Company would reap benefit therefrom. This hope had been more than fully justified, because on the cessation of operations by the Coalite Company at the works at the end of September, 1910, the Company, for an almost nominal sum, became possessed of absolutely necessary plant and machinery, the purchase and installation of which would have involved a very heavy expenditure. This plant and machinery would be of great benefit to the Company; but a further and most important addition to the works during the year had been made in the erection of an additional gasholder. The consumers of gas were constantly increasing in number to a very satisfactory extent. The price of gas had been reduced 2d. per 1000 cubic feet; and the Directors had inaugurated a system of supply for heating purposes at the low price of 2s. 6d., which it was anticipated would produce satisfactory results. The profit and loss account showed that, after providing for interest on debenture stock, bank overdraft, and trading accounts, there remained a credit balance of £1095. The Directors recommended that out of this the full dividends should be paid on both classes of the preference shares, which would absorb £211, and leave £884 to be carried forward. On the year's working, a dividend on the ordinary shares would be justified; but unfortunately the large amount of the liabilities on capital and trading accounts left no funds available out of which the dividends could be paid on the present occasion. In conclusion, the Directors expressed the feeling that the hearty thanks of the shareholders were due to the Company's Engineer and Manager (Mr. C. B. Tully) for the very able and vigorous manner in which he had, with their assistance, achieved such successful results. He had in a very large measure been the means of bringing the Company from a losing to a profit-earning concern, with such excellent prospects that in the near future there could be no doubt that dividends would be paid on all classes of the Company's capital. The report was adopted. The Directors were subsequently authorized to raise additional capital under the Provisional Order of last session.

LONDON WATER SUPPLY DURING THE DROUGHT.

At the Meeting of the Metropolitan Water Board last Friday—the first after the summer recess—the Works and Stores Committee reported that, notwithstanding the continued drought during the past summer, the supply of water throughout the whole of the Board's area had been maintained without intermission, and that very few complaints as to deficiency had been received. It had been necessary to make special provision for the better supply of certain areas; and the value of the intercommunication system had been substantially appreciated. A statement from the Engineer showed that the total number of complaints received as a result of insufficiency of pressure during the months of June, July, and August, was 374; giving an average of 125 per month. This worked out at one complaint per month for every 8818 supplies, or equivalent to one complaint per month for every 57,004 persons served—a condition of affairs which the Committee considered entirely satisfactory, having regard to the conditions prevailing during that period. The Board were greatly indebted to the Thames Conservancy for the admirable manner in which they had co-operated with regard to the abstraction of water from the river to the best advantage. The week of maximum demand last year was that ended June 24, when the average daily supply was 261,333,000 gallons, and the supply per head per day 37 gallons. During the past summer, this quantity had been exceeded on no fewer than twelve occasions; and the week of maximum demand was that ended July 28, when the average daily supply was 300,094,857 gallons, or a supply per head per day of 42·1 gallons. The Committee recommended: "That an expression of the Board's thanks be accorded to the Deputy Chief Engineer (Mr. J. W. Restler, M.Inst.C.E.), and to the whole of the staff of the engineering department, for the manner in which the supply of water to the consumers throughout the Board's area had been maintained during the recent drought; that the Clerk be instructed to communicate with the several local authorities throughout the Board's area on the subject of the maintenance of supply during the recent drought, and that members of the Board be invited to direct the special attention of their respective authorities to the matter; and that the Board do place on record their appreciation of the great assistance rendered by the Thames Conservancy in co-operating with the Board with regard to the abstraction of water from the River Thames."

Sir MELVILL BEACHCROFT considered the report to be the most interesting that had ever been presented to the Board; and he thought the members must have read it with the greatest possible satisfaction. He could not help wondering where they would have been but for the Intercommunication Act of 1899, which was passed by Parliament under the pressure of very adverse circumstances as far as weather was concerned.

The CHAIRMAN (Mr. E. B. Barnard) fully agreed with Sir Melvill Beachcroft. After what had been happening in other towns all over the country, he thought it was a matter for enormous satisfaction that London could claim that, whereas in the last three months she had a supply of more than 300 million gallons of water in one day to upwards of 7 million people, they had never withheld the constant service. There had not been any cessation, and the domestic supplies had been fully maintained. Under all the circumstances, considering the very dry period which the Board had gone through, he thought they had some reason to be proud of the result. They were more than gratified and pleased with the zeal and fidelity of their officers, who had been responsible for this achievement.

The recommendations were agreed to.

WELSH WATER FOR BIRKENHEAD.

Commencement of the Alwen Scheme.

Last Tuesday, the Chairman of the Water Committee of the Birkenhead Corporation (Alderman Bloor) laid the foundation stone of the new gravitation works on the River Alwen, in North Wales, which will furnish a large additional supply of water to the borough. There was a numerous company present, on the invitation of the Mayor (Mr. A. W. Willmer), including Colonel Cornwallis West (the Lord Lieutenant of Denbighshire), the Mayors of Wallasey, Bootle, Chester, Ruthin, and Denbigh, Sir Alexander Binnie (Engineer-in-Chief to the Corporation), Mr. A. Bigland, M.P., Mr. Joseph Parry (Water Engineer to the Corporation of Liverpool), Mr. T. H. Parkin (Resident Engineer), Mr. J. Macdonald (Contractors' Engineer), Mr. Martin Deacon, and Mr. MacAlpine, jun. (members respectively of the Engineers' and Contractors' firms). The ceremony was performed with a silver trowel, presented by the Contractors (Messrs. Robert MacAlpine and Sons, of Glasgow and Westminster); and a luncheon followed. Particulars of the scheme have already been given in the "JOURNAL;" but it may be of interest to indicate again its principal features.

It is rather more than ten years since the Corporation of Birkenhead took into serious consideration the question of the future water supply of the borough. In 1900, a Special Committee was appointed to deal with the subject; and the services of the late Dr. G. F. Deacon, who had been closely associated with the Vyrnwy scheme of the Liverpool Corporation, were secured. In 1902, he presented a preliminary report on the result of his examination of many areas in North Wales which were suitable as sources of water supply by gravitation for Birkenhead. He suggested at least three schemes which would give the required quantity of 10 million gallons a day; and finally the Corporation selected the project now commenced, which embraces the construction of large reservoirs, in the Denbighshire mountains, on the upper reaches of the River Alwen, a tributary of the Dee. In taking this step, the Corporation were fortified by the approval of a number of experts, including Sir Alexander Binnie, Professor W. Boyd Dawkins, and Dr. H. R. Mill, whose opinions on the points of engineering, geology, and rainfall were highly valuable. The quality of the water was also reported upon by the late Professor J. Campbell Brown and the late Sir Thomas Stevenson.

The original plan was to construct three reservoirs—the Alwen, the Brenig (upon a tributary stream of that name), and the Glan Alwen;

the last being intended solely for the supply of compensation water. However, before the Act authorizing the scheme was obtained in 1907, the Glan Alwen section was struck out; leaving powers to construct the two larger reservoirs. Protracted negotiations with property owners followed; and it was decided to proceed first with the Alwen section of the works, which are estimated to cost about £1,250,000. For the mountain valley site the landowner claimed £100,000; but, after an arbitration extending over eight days, the amount of the purchase money was fixed at £26,518. On the death of Dr. Deacon, in 1909, the undertaking was entrusted to the firm of Sir Alexander Binnie, Son, and Deacon; and by January last all the surveys, plans, &c., were so far completed as to enable the Corporation to give out the contract for the construction of the masonry dam which will impound the water of the Alwen and create the reservoir. It amounts to £186,153. This dam is the principal feature of the work now in progress. It will be a structure curved in plan to a radius of 500 feet, will be 92 feet in height above the bed of the stream, 458 feet in length, and will contain 40,000 cubic yards of masonry. It will be provided with a tower, and will carry a roadway, beneath which the overflow from the reservoir will pass through eight openings. Each end of the dam will be terminated by heavy masonry piers. At the foot of the apron on the down-stream side of the dam will be situated the valve-house, in which will be placed the valves for controlling, and the meters and gauges for measuring, the supply to the borough, the compensation water to the stream, and the overflow from the reservoir. The rainfall on the Alwen area will, with the reservoir, be sufficient to yield about 11 million gallons of water per day, including compensation water.

The present contract deals only with the construction of the dam and reservoir. The latter will have a total capacity of 3000 million gallons, a top-water area of 375 acres, and be situated 1200 feet above sea-level. Other important parts of the undertaking still to be provided are the aqueduct to convey the water to Birkenhead, filter-beds near the reservoir, a length of tunnel for the aqueduct near the Vale of Clwyd, and a service reservoir on high ground near Birkenhead to command the existing large reservoir inside the town. The aqueduct from Alwen to Birkenhead will be 42 miles long, and be composed of iron and steel pipes, varying from 20 to 30 inches in diameter, with the necessary balance-tanks at intervals.

LINCOLN WATER SUPPLY.

Inauguration of the New Works at Elkesley.

Last Tuesday afternoon the members of the Lincoln Corporation, accompanied by a number of the citizens, visited the pumping-station at Elkesley for an inspection preliminary to the ceremony of inaugurating the new works, which were described in the "JOURNAL" last week (p. 56), fixed for the following day. The visitors were shown one of the two marine type inverted triple-expansion engines at work, with a steam pressure of 180 lbs. to the square inch, pumping water from the boreholes, more than 500 feet below, into the settling-tanks. From these the high-lift pumps take the water through the great main, carried over the River Trent upon a steel bridge, into Lincoln. There it is distributed from a water-tower—a prominent building upon the high ground near the Cathedral—into the new Bracebridge reservoir, and thence through the city mains into the houses of the inhabitants. Before the visitors left, the two great engines were "christened"—a bottle of champagne being broken against each of them. These ceremonies were performed by the Mayoress (Mrs. C. H. Newsum) and by Mrs. M'Kechnie Barron, wife of the Water Engineer.

Wednesday was a gala day in Lincoln; the citizens making holiday in honour of the inauguration of the new water supply, the completion of which was regarded as a turning-point in the history of the city, and the closing of an unpleasant episode. There was a service in the Cathedral, which was attended by the Mayor and members of the Corporation in state, and at which the Bishop gave an address. From the Cathedral the civic authorities walked in procession to the Arboretum. There, after the Town Clerk (Mr. W. T. Page) had given a short historical account of the city's water undertakings, the Water Engineer filled a silver cup with water from a tap which had been placed upon the platform, and handed the draught to the Mayor. Mr. Newsum drank of the water, which he pronounced "very good indeed," and then turned a handle, and immediately the new water rose in a cascade from a fountain in the grounds. The people cheered, maroons were fired, and the bells of the Cathedral and the city churches rang out in joyful peals. The hymn "Now thank we all our God," sung with great heartiness, ended the ceremony. In the evening, the citizens gave a commemorative dinner to the Mayor and Corporation in the Assembly Rooms; while in the Arboretum there were illuminations and a musical performance.

LEEDS CORPORATION WATER SUPPLY.

Progress of the Leighton Reservoir and Colsterdale Catchwater.

Under the guidance of Mr. Arthur Willey, the Chairman of the Water Committee, the members of the Leeds Corporation paid a visit, on Monday last week, to the site of the Leighton reservoir and the catchwater at Colsterdale, for the usual annual inspection. On reaching the moorland where the new works are being constructed, the visitors, accompanied by Corporation officials and representatives of the Contractors (Messrs. H. Arnold and Son), walked to the point where the waters of Spence Gill are to be intercepted, turned into a trench, and used as a feeder for the reservoir. This conduit will be fully two miles long. Already 1500 lineal feet have been completed; and by the substitution of concrete for stone, a saving of £9000 is being effected. Much progress has been made with the reservoir itself during the past twelve months. Trenches more than 100 feet deep have been filled with concrete; the support trenches, started in April to prevent the movement of what is called "Bible" clay, because it adheres in layers like the pages of a book, are well on the way to completion; and broad, deep trenches of impervious clay are being constructed at the lower end of the reservoir site. The tunnel, the by-wash channel, and other parts of the work were examined by the members of the Water Committee, and satisfaction was expressed at the solid way in which the foundations were being laid. Of the £500,000 that are being spent, a sum of £240,000 has been sunk in the ground. The reservoir is, according to contract, to be completed in 1915. Its drainage area is 4700 acres; and it will have a capacity of 1136 million gallons.

Luncheon was served in the workmen's recreation-room—Mr. Willey presiding. In the course of his remarks after the repast, he mentioned that the Corporation had also purchased land higher up for the Colsterdale reservoir, and also the Laver Estate, on which they could eventually, if necessary, have two reservoirs. He did not think, however, when the Leighton reservoir was completed, there would be any necessity to embark on another scheme for at least thirty years, or longer, because the new reservoir would supply from 3½ to 4 million gallons a day, exclusive of compensation water.

FORESTRY IN WATERSHED AREAS.

The returns that are possible from forestry work on reservoir lands are shown by some figures given by Mr. F. W. Rane, States Forester of Massachusetts, in the "Journal of the New England Water-Works Association" for June. They relate to 942 acres of land on the catchment basin of Westfield, about half of which is now wooded, and nearly half could be planted. If rational forestry were conducted on this tract, it is estimated that about $140,000 net profit could be obtained during the next fifty years. Another example is given in the same place by Mr. W. F. Sullivan, Engineer and Superintendent of the Pennichuck Water-Works, which are owned by a private company who have conducted forestry work for some time. While he gave no actual figures, he said that careful attention to forestry work, instead of reckless slashing at the trees, was well worth the effort.

The economic feature of the matter is brought out more clearly from other figures given by Mr. Rane, and quoted in "Engineering Record." He stated that there are about 11,000 acres of water-supply lands adapted for forestry in Massachusetts. On the basis of the cost of such work done by the Metropolitan Water Board on about 1200 acres set out with hardwood and pine, the expense per acre will be about as follows: The cost of planting will be $20 per acre, and this sum at 3½ per cent. compound interest will amount to about $112 at the end of fifty years. Improvement cutting will cost $6, which will amount in forty years to about $24. Fire patrol will cost 25 c. annually; and this, with interest, will amount to $34. The total expense is thus about $170. The stumpage yield will be about $465 at the present prices, which are steadily rising, leaving a profit of $295 per acre above interest charges, or 7½ per cent. per annum. The total for the whole acreage is $3,190,000—a net profit which is being overlooked.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards resumed their sales of gas and water stocks and shares. Two new issues of capital—by the Dartford Gas and Southend Water Companies respectively—were offered, under instructions from Directors. The former issue was £5000 of ordinary 5 per cent. stock; and it was all sold at from £95 10s. to par. The Water Company had 1250 new ordinary £10 shares (5 per cent. maximum and 4½ per cent. present dividend) for disposal; and they fetched £10 to £10 2s. 6d. each. By order of Trustees, 300 fully-paid original £10 shares in the South Kent Water Company, ranking for a maximum dividend of 10 per cent., but carrying only 2½ per cent., realized £5 to £5 2s. 6d. apiece. A few "A" shares in the East Grinstead Gas and Water Company (maximum dividend 10 per cent., present dividend 9½ per cent.) were sold at £18 each, and some "A" stock (similar dividends) at £182 to £184 per £100. The final lots were some £10 "B" and "C" 7 per cent. shares in the same Company, carrying £6 13s. per cent. dividend; and they fetched respectively £12 15s. and £12 10s. each. At the Assembly Rooms, Weston-super-Mare, next evening, Mr. C. E. Masters, in conjunction with Messrs. Lalonde Bros. and Parham, offered for public competition £5000 of new 5 per cent. maximum ordinary stock of the Weston-super-Mare Gas Company, in lots of the nominal value of £50. The stock was quickly disposed of at from £57 7s. to £57 15s. per lot—the greater part of it at the latter figure.

Architects and Gas-Fires.—The following remarks were among the "General News" in the "Builder" recently: "The question of heating buildings, domestic and otherwise, has engaged the active attention of architects for many years; and, particularly in London, the 'City of Fogs,' where the damaging effects of the smoke nuisance are so manifest, this activity has of late largely been devoted to studying the question from a more scientific aspect than hitherto—*i.e.*, not merely from the point of view of obtaining heat and that only, but of obtaining it in its most convenient and hygienic form. Of late years, in this country especially, where the vagaries of the climate have been so marked at all seasons of the year, the coal-fire has to some extent fallen out of favour, for the simple reason that it is not possible to adapt this means of heating to the varying temperatures to which we are subjected; and, as a consequence, a system of heating that is always instantly at the will of the user is becoming more widely known and adopted day by day. We refer to the gas-fire. This means of heating has found a good deal of favour with those who are in a position to appreciate the advantages to be gained thereby. The work that the largest Metropolitan Gas Company have undertaken in offering to architects the free fixing of gas-fires for a trial period, may induce members of the profession who have not had personal experience of modern gas heating to take this opportunity to study the subject more closely. If they do, it may lead to their advising the still wider adoption of this system of heating."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

To-night's meeting in Glasgow sends the Western District of the Scottish Junior Gas Association off upon its winter's work. The item of technical business, consisting of a lecture upon Gas-Governors by Mr. W. Carmichael Peebles, of Edinburgh, was a subject well chosen for exposition in these days when the governing of gas has become of much more importance than it used to be. The choice of the lecturer, too, was the happiest which could have been made. Who is likely to know more intimately the problems attending the means for regulating the flow of gases than a son of so distinguished a student in that line as the late Mr. D. Bruce Peebles? He showed a familiarity with his subject which was perfect; and his clear but terse descriptions, while they made everything plain to the listeners, added a charm to the address which will make it remembered as one of the best communications which the Association has yet had. The circumstance that Mr. F. Cuthbert, the Vice-President, has gone to fill a situation in London, required Mr. M'Ghee to take the chair a year earlier than he would have done; and it was necessary to appoint a new Vice-President, in room of Mr. M'Ghee. The choice fell upon Mr. F. L. M'Laren, of Dumbarton, an old and tried member of the Association. With a good programme in front of the Association, there is every reason to look for a prosperous session.

Besides the question of the valuation of their undertaking, referred to in last week's "Notes," the Edinburgh and Leith Gas Commissioners have under negotiation at present another question of much importance to all owners of gas-works—viz., the adjustment of the income-tax. The Commissioners have lodged appeals against the assessment by the local assessor of income-tax on their undertaking for the three years 1907-10. The grounds of appeal are mainly in respect of the authorities having declined to grant any allowances for: (1) The superseding of the old works by the new works at Granton; (2) the compensation and law expenses paid in connection with the actions at the instance of Messrs. James Muir and Sons, Limited; (3) the recent alterations at Waterloo Place; and (4) annual depreciation of plant. The Commissioners have claimed that they should be allowed relief from income-tax on £44,280, in respect of items 1, 2, and 3. Negotiations have been going on between the income-tax authorities in Edinburgh and the Gas Commissioners for the last three years. The Commissioners have had several meetings with the authorities, and the Engineer, Clerk, and Treasurer have also had very many meetings, and a vast amount of correspondence, with three or four local assessors; but practically no progress has yet been made. The local assessor will not so far admit the Commissioners' claim that the 2d. per 1000 cubic feet of gas sold, authorized by the 1908 Order to be contributed to the reserve fund for meeting the deficit on sale of disused works, should be free from payment of income-tax. As such contributions will be required for many years to come, it will be seen that it is not alone the three years 1907-10 that will be affected. The local assessor has now suggested that the matter should be dealt with directly by the head officials in London, and that the Gas Commissioners should appoint their representatives to attend an early meeting there, in the expectation that such meeting would result in an understanding being arrived at which would obviate further trouble. The Finance and Law Committee of the Gas Commission have instructed the Clerk to invite the Somerset House officials to attend a conference on the subject in Edinburgh; and the Gas Commissioners have approved of this course being followed.

The Peterhead Town Council on Monday spent a long time over the financial position of the gas undertaking, regarding which irregularities were alleged to exist. The Gas Committee reported that they met on Sept. 29, and took into consideration a report by Messrs. Meston and Co., of Aberdeen, and a letter on the subject from the Secretary for Scotland, dated Sept. 22; and after a full discussion of the position of matters, they remitted to the Convener (Bailie Birnie), the Town Clerk, and Mr. W. A. Reid, of Messrs. Meston and Co., to frame answers to the Secretary's letter. The Committee also reported that Mr. Reid stated to them fully his views as to the cause of the irregularities which were brought out in his firm's report, emphasizing the fact that, in his opinion, apart from the Gas Manager's over-valuation of stocks, &c., the defective book-keeping of the Treasurer had been a serious factor in contributing to the position which had arisen, not only as regarded irregularity of method, but also in the want of co-operation with the Gas Manager. With reference to the irregularities of the Gas Manager, the Committee looked upon these as being very serious, inasmuch as a fictitious position of the undertaking had been given for the past few years; and they resolved that the Manager be severely censured for his conduct. The Committee questioned Mr. Reid as to whether he had found out any signs of defalcation on the part of any of the officials; and he stated that he had found no trace of any money belonging to the Corporation having been misappropriated. The Committee also discussed fully with Mr. Reid the financial position of the undertaking, and obtained his assurance that it was thoroughly sound, and that, notwithstanding the irregularities disclosed, he could not find that the Town Council had been materially prejudiced. They took into consideration the recommendation of the Secretary for Scotland as to the administration of the undertaking, in view particularly of the position of the Treasurer; and the Town Clerk had given it as his opinion that it was incumbent on the Town Council to have only one Treasurer for the burgh. The Commissioners accordingly resolved to recommend that the Town Chamberlain be asked to undertake the duties of Gas Treasurer in addition to his existing duties. In the meantime, they deferred formulating the duties as between him and the Gas Manager. After full consideration of the position, the Committee were unanimously of opinion that Mr. W. Ritchie's services as Gas Manager should be continued; and they unanimously resolved to recommend to the Town Council accordingly. With regard to the overpayment of income-tax, the Committee instructed Mr. Reid to lodge a claim for the return of the excess payments. Mr. J. Gordon moved that the minute of the Committee be not approved. He pointed out that the unfortunate position of the gas-works was first brought before them by the Secretary for Scotland's letter of Feb. 3 last. Their accounts for the year ending May 15, 1910, had been duly audited, and, subject to certain observations, had been certified by the Auditor (Mr. A. Davidson, C.A., of Aberdeen) to be correctly stated and duly vouched; and they had naturally assumed that all was right and well at the gas-works. The Secretary for Scotland's letter came upon him as a most unpleasant revelation. When he referred to the printed abstract of accounts, he saw that they showed amazing figures. The stock of coal, &c., at Whitsunday, 1909, was shown at £1813, and the sum paid for coal during the year to Whitsunday, 1910, at £5891—a total of £7704. There were carbonized 5074 tons of coal, at 16s. 7d. per ton—about £4207; and the stock, &c., on hand at Whitsunday, 1910, was put at £826, a total of £5033—leaving £2671 or thereby to be accounted for. There was not a word of explanation or excuse as to how the Auditor granted the certificate of Sept. 28, 1910. The accounts had been audited every year; but Messrs. Meston told them that the coal stock was overstated as at May 15, 1909, by not less than 1443 tons. They were told this was really only a book-keeping error, and that, had the accounts been properly kept during the last eight years, it would have been unnecessary to make this grave misstatement of 1443 tons. He considered that to enable the ratepayers to judge of the value of the assurances which had been given them, the Secretary for Scotland's letter and Messrs. Meston's report should be published. He entered his protest against the action of the Gas Committee in trying to shield the Gas Manager by endeavouring to put a considerable part of the blame upon the late Treasurer. Mr. Clubb moved that the minute be adopted, and that an independent valuator be called in every year in future to take stock. Several other gentlemen spoke, including Mr. W. A. Reid, who repeated his assurance that he could not find any trace of dishonesty or any leakage, but that there had been a good deal of slackness, and that it gave him pain to say that the Treasurer's work had been singularly and uniformly defective for many years back. The minutes were adopted by ten votes to two. Mr. Gordon dissented, and gave notice that he would move that the letter from the Secretary for Scotland and the report of Messrs. Meston be published.

The Town Council of Fraserburgh are getting into harness in the matter of the working of the gas undertaking, which came into their hands recently. On Thursday, the recommendation of a Sub-Committee to the effect that the present staff at the gas-works be retained was adopted. The Convener of the Sub-Committee, and Mr. H. G. Ritchie, the Gas Manager, were instructed to visit the gas exhibition which is being held in Aberdeen, with a view to getting insight into the most up-to-date methods of using gas.

The North Berwick Town Council on Tuesday reduced the price of gas from 3s. 1½d. to 2s. 11d. per 1000 cubic feet. Mr. Blyth, the Convener of the Committee, remarked that the price of gas when the undertaking was owned by a Company was 6s. 8d. per 1000 cubic feet. The old works were purchased by the Council for £6000, and since that time they had built new works at a cost of £18,000. In spite of all this outlay, they were able to reduce the price of gas to 2s. 11d.—a figure never before known in the burgh. Provost Macintyre considered that the Gas Committee were deserving of their congratulations for the very economical and satisfactory way in which they had looked after the department. The Manager—Mr. J. Black—was awarded a cordial vote of thanks.

It is announced to-day that the total cost to the Corporation of Kirkcaldy of the acquiring of the undertaking of the Kirkcaldy Gaslight Company, Limited, has been £145,324. As Lord Shaw's decision awarded the Company £137,150 for their undertaking, it follows that the cost of the transfer, including the protracted arbitration proceedings, has been £8174—a somewhat stiff sum to pay for the business acquired. It should be remembered, however, that the claim of the Company was for £224,000. So, in one sense, the going to arbitration has been a means of gain to the Corporation.

An exhibition of gas appliances for lighting, heating, and cooking, which bids fair to be a pronounced success, was opened in Aberdeen yesterday. In Aberdeen no doubt is entertained as to the value of such exhibitions, because this one has been dictated chiefly by the great volume of business which resulted from the holding of an exhibition five-and-a-half years ago. The Corporation are the promoters of this exhibition, as they were of the former one. In this capacity they are able to control what is shown, and to put before the community that which, from local knowledge, they are conscious the people want. Great care has been bestowed upon the getting up of the exhibition, which was only what was to be expected from Mr. S. Milne, the Gas Engineer. The Corporation are wisely acting very generously towards the exhibition, thereby manifesting their enlightened and broad-minded views regarding a subject which, although many municipalities do not yet recognize it, is, or ought to be, one of the foremost in the region of current consideration.

Wiesbaden Gas Undertaking.—The report on the working of the gas undertaking of the Wiesbaden Corporation for the financial year 1909-10 states that the increase in gas consumption, as compared with the previous year, was only 2·09 per cent. The smallness of the increase is accounted for by the bad state of trade and the increase in the price of gas from 4s. to 4s. 6d. per 1000 cubic feet. The make of gas amounted to 444,095,000 cubic feet, of which 84·1 per cent. was coal gas and the remainder water gas. The unaccounted-for gas amounted to 4·61 per cent. of the total production. The make of coal gas per ton of coal carbonized averaged 11,037 cubic feet.

Reduction in Price at Ripon.—At a recent meeting of the Ripon City Council, Alderman Walker submitted a recommendation of the Gas Committee that a reduction from 3s. 4d. to 2s. 11d. per 1000 cubic feet, with the present discounts, should be made in the price of gas. He said they were encouraged to do this by a reduction of £1250 in the debit balance at the bank; and in addition to this, they hoped to save £400 in the coal bill, and to effect economies in the general management. The Mayor (Mr. Walter Fennell) thought that, in view of possible trouble in connection with the coal trade, it would be better to postpone any reduction in the price of gas until they had further cleared off the balance at the bank and formed a reserve fund. The Council, however, confirmed the recommendation of the Committee.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 134.]

LIVERPOOL, *Oct.* 7.

Sulphate of Ammonia.

There has been a good demand throughout the week, and all available supplies have been readily taken up at hardening prices. A fair amount of the requirements have been for the purpose of covering previous sales; but direct buyers, both in this country and abroad, have also come into the market for further quantities. The nearest values at the close are £14 2s. 6d. per ton f.o.b. Hull, £14 3s. 9d. per ton f.o.b. Liverpool, and £14 6s. 3d. per ton f.o.b. Leith. For future delivery there has likewise been more inquiry, and business has been recorded for October-December, 1911, delivery at £14 5s. per ton, and for January-April next year at £14 7s. 6d. per ton, in equal monthly quantities, f.o.b. at the principal ports.

Nitrate of Soda.

The tone of this market is strong, and sellers remain very firm at 10s. per cwt. for 95 per cent. quality, and 10s. 3d. for 96 per cent. quality, on spot.

LONDON, *Oct.* 9.

Tar Products.

The markets for tar products are still very firm. Pitch is decidedly steady; and there appears to be a little more inquiry. Benzol is very firm for prompt delivery. As to crude carbolic, various prices are reported to have been paid for one or two lots; but it is difficult to make the real value more than 2s. 2d. to 2s. 3d. per gallon—in fact, actual consumers will not pay this price. Solvent naphthas are steady, and improved prices are reported to have been paid. Heavy naphthas are in fair demand. Creosote is exceedingly firm.

The average values during the week were: Tar, 21s. to 25s. *ex* works. Pitch, London, 40s. 6d. to 41s. 6d.; east coast, 40s. to 41s.; west coast, Manchester 39s. 6d. to 40s. 6d., Liverpool 40s. to 41s. Benzol, 90 per cent., naked, London, 9½d. to 10d. f.o.b., North, 8¾d. to 9¼d. f.o.b.; 50-90 per cent., naked, London, 8½d., North, 8d. to 8¼d. f.o.b. Toluol, naked, London, 8½d.; North, 7¾d. to 8d. Crude naphtha, in bulk, London, 4¼d. to 4¾d.; North, 3½d. to 3¾d. Solvent naphtha, naked, London, 9¼d. to 9½d. f.o.b.; North, 8d. to 8½d. f.o.b. Heavy naphtha, naked, London, 10¼d. to 10½d. f.o.b.; North, 9d. to 10d. f.o.b. Creosote, in bulk, London, 2⅞d. to 2¾d.; North, 2⅜d. to 2½d. Heavy oils, in bulk, 2⅝d. to 3⅛d. Carbolic acid, casks included, 60 per cent., east coast, 2s. to 2s. 2d.; west coast, 1s. 11d. to 2s. 1d. Naphthalene, £4 10s. to £9 10s.; salts, 42s. 6d. to 45s., bags included. Anthracene, "A" quality, 1⅛d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article continues steady, although there is not a large amount of foreign buying. Actual Beckton is still quoted £13 15s.; ordinary London makes, £13 7s. 6d.; Hull, £14 1s. 3d. to £14 2s. 6d.; Liverpool, £14 2s. 6d. to £14 3s. 9d.; Leith, £14 5s. to £14 6s. 3d.; Middlesbrough, £14 to £14 1s. 3d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a strong demand for coals, partly because of a desire to stock fuel in preparation for any labour dispute. In the steam coal trade, best Northumbrians are, on the other hand, affected by the limited shipments to the Mediterranean through the turmoil there. They are quoted from 10s. 10d. to 11s. 3d. per ton f.o.b.; while second-class steams are from 9s. 3d to 9s. 9d., and steam smalls steadier from 5s. to 6s. Gas coals are generally firm, as the home requirements are now increasing more rapidly. Durham gas coals are, for best kinds, from 11s. per ton f.o.b., second-class from 9s. 9d. to 10s. 3d., and "Wear specials" about 11s. 6d. At the same time, the Italian outbreak may throw some coals on the market; and there are rumours that a quantity of good Durham gas coal has now been sold for delivery over next year at about 10s. 5d. per ton f.o.b., while other lots are being treated for. More settled weather, and the increasing home demand for gas coals, may soon stiffen the market. Coke is steady generally. Gas coke is now more plentiful, and good makes are quoted from 13s. 9d. to 14s. per ton f.o.b.

Scotch Coal Trade.

Trade was very active during the past week, and every class of coal experienced an advance in price. It is reported that collieries are well supplied with orders. The prices now quoted are: Ell, 10s. to 11s. per ton f.o.b. Glasgow; splint, 10s. 9d. to 11s.; steam, 9s. 6d. to 9s. 9d. The shipments for the week amounted to 323,255 tons—a decrease on the preceding week of 60,763 tons, and on the corresponding week of 20,731 tons. For the year to date, the total shipments have been 12,283,047 tons—an increase upon the corresponding period of 141,911 tons.

Instruction for Plumbers and Gas-Fitters.—In the course of a report recently presented by the General Secretary of the International Federation of Ironmongers' Associations, he stated that a meeting of representatives of the Manchester District Institution of Gas Engineers had been attended by the Plumbers' and Gas-Fitters' Operative Society and the Gas-Fitters' Association of Birmingham and others interested in the gas industry. The meeting was called primarily to confirm proceedings at others that had been held; the main object being to establish an educational school for the teaching of people employed in the gas industry. Much discussion took place, and in the main the syllabus was considered too scientific, and was referred back to the Institution to report to a further meeting.

THE "DARWEN" ARCH PIPE

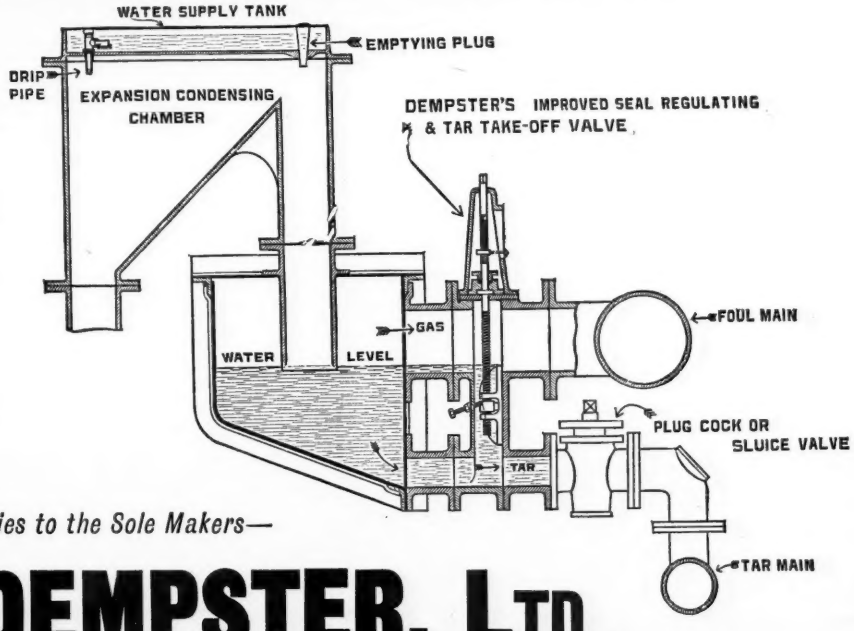
Prevents Stopped Ascension Pipes.

"The Cost is moderate and can be saved in a Single Season."

"The Arch Pipes can be seen in operation upon application."

"It will pay you to try them upon troublesome Pipes."

Upwards of **400** are already at Work or on Order.



Please address all Enquiries to the Sole Makers—

R. & J. DEMPSTER, LTD.,

GAS PLANT WORKS, **MANCHESTER.**

Gas-Works for Bugsworth.—The Chapel-en-le-Frith, Chinley, and District Gas Company have commenced the erection of new gas-works at Bugsworth. Since they acquired the gas undertakings at Chapel-en-le-Frith and Whaley Bridge, the Company have laid mains connecting Chinley and Bugsworth with these places; but it is intended ultimately to supply the district from the new gas-works at Bugsworth.

Bury and District Joint Water Board.—In his annual statement to the Bury and District Joint Water Board, Mr. R. W. Buxton, the Treasurer, reports that the deficiency on the year's working was £11,637, or £3029 less than in the preceding twelve months, while the precepts on the constituent authorities were appreciably lessened, representing a decrease of about 1d. in the pound on the rates in each district. The receipts from domestic supply during the year totalled £42,100.

Rewards for Loyal Employees.—The Liverpool City Council have agreed to recommendations by the Tramways, Electric Power, and Lighting Committee that one extra week's pay be granted to all employees in the Tramway General Manager's Department (including the salaried staff) who were in the service at the time of the recent strike, and who remained loyal to their duty; that one week's extra pay be granted to the members of the salaried staff of the Resident Electrical Engineer's Department who were drafted on to emergency work during the strike; that a sum be paid to members of the Tramway wages staff for extra services during the strike period; and that one week's extra pay be granted to all the lamplighters, automatic lamp attendants, and members of the worskshop staff of the Lighting Department who were in the service at the time of the strike, and who remained loyal to duty.

Torquay Water Supply.—According to present appearances, the Torquay Corporation will shortly be faced with the necessity of laying a new trunk main from the reservoirs on Dartmoor to the town. At present, the water is conveyed through two mains. One of these, which was laid in 1856, has a diameter of 10 inches to Newton Abbot—which derives its water supply from the Torquay works. The second main, laid in 1883, is 10 inches in diameter throughout. During the recent hot weather, the demand for water has exceeded the capacity of the mains. They are capable of carrying 2,250,000 gallons per day; but the consumption has exceeded this, and at times the water has had to be cut off in parts of the district during the night, so that the small service reservoir might be filled. As there is abundant storage for the present, the question is only one of the conveyance of the water. It is pointed out that the older pipe has already done duty for about ten years beyond the average life of mains of its kind, and that in any case its replacement would probably be only a question of a few years. A new 12-inch or 14-inch main, such as is now required, will, however, cost £30,000, and will add £1500 to the charges for interest and sinking fund. This will fall wholly upon Torquay, as Newton Abbot is at present paying the maximum charges under the Act. An increase of the water-rentals in Torquay is thus foreshadowed.

Reduced Charges for Gas-Cookers at Salford.—The Salford Town Council, at last Wednesday's meeting, approved of the following revised charges for the use of gas-cookers, as submitted by the Gas Committee: From 1s. 9d. to 1s. 6d., 2s. to 1s. 10d., 2s. 3d. to 2s.; 2s. 6d. to 2s. 4d., 2s. 9d. to 2s. 7d., and 3s. 9d. to 3s. 6d. per quarter. The Council also agreed that during the two winter quarters, from Oct. 1 to March 31 inclusive, the prices charged should be at one-half these rates.

Trèves Gas Undertaking.—We learn from the report on the gas-works of the Trèves Corporation for 1910 that new scrubbing plant and new coke conveying and sorting plant were brought into use in the course of the year. A balloon-filling station was also provided. The total make of gas amounted to 148,359,000 cubic feet. The make per ton of coal averaged 10,876 cubic feet, and the coke consumed in heating the retort furnaces amounted to 13·50 per cent. by weight of the coal carbonized. Water gas, carburetted by means of benzol, was added to the extent of 14·2 per cent. of the total output. The profits of the undertaking showed an increase over those for the previous year.

Municipal Coal.—During a discussion in the Batley Town Council on the question of contracts for coal, Mr. Turner advocated a municipal coal supply. He pointed out that the Corporation could buy coal much cheaper than could either millowners or householders. Already, he said, the Corporation sold municipal gas and coke made from the coal; and he did not see why they should not go a step farther and purchase a few hundred thousand tons more coal, and sell to the ratepayers at a cheaper rate than they could purchase it themselves at the present time. Alderman Akeroyd ridiculed the proposal, and said he would like to suggest that the Corporation should purchase a colliery and supply both the Gas Committee and the inhabitants of Batley with coal. He was interested in a colliery himself; and he would be glad to take 70 per cent. of the value of his shares in the concern, if they would purchase.

Uncertainty at Carnarvon.—Some weeks ago, at a special meeting, the Carnarvon Town Council decided to have a scheme of electric lighting, on condition that the cost to the ratepayers should not exceed £100 a year: but at the following ordinary meeting, the validity of this decision was challenged. Mr. Hughes pointed out that only fourteen members attended the special meeting, and no more than eight voted in favour of the scheme—upon which "public opinion was also very divided." Mr. Pritchard explained that the scheme would cost the ratepayers nothing, inasmuch as the adoption of electricity would reduce the payment for gas to the extent of £84 a year; and the scheme would also ensure double the light obtained at present from gas. Dr. Parry said that in going back upon what had already been decided, they were playing with the public and with the Electric Light Company. Mr. Davies characterized as unbusinesslike the proposal to withdraw £84 from the gas undertaking, which belonged to the Corporation, and transfer it to the Electric Light Company, which was not the ratepayers' concern. Ultimately it was decided to consider the matter at another special meeting.

URGENCY!

WE referred a fortnight ago to the probable Coal Strike, and we again venture to urge you to place your stock order for Gasfires immediately, and in large quantities, not only because of the outlook in the coal industry, but because the whole of the Gas World is becoming alive to the advantages of the Simple Hiring of Gasfires. Even Corporate bodies are adopting this system throughout the Kingdom, and there is every prospect of this season seeing a greater demand for Richmond's "A.B.C." Gasfires than ever before—in fact, our orders to date show an enormous increase on any previous season.

The reason for the continued popularity of our "A.B.C." series is primarily owing to their Interchangeability and high Radiant Efficiency. The series consists of Sixteen Gasfires and only three sets of parts required for renewal. We confidently invite the closest possible tests and investigations.

THE RICHMOND GAS STOVE & METER CO., LTD.,

GASFIRE SPECIALISTS.

Offices & Showrooms: 132, QUEEN VICTORIA ST., E.C.

Offices & Works: ACADEMY ST., WARRINGTON.

Inventors of the Interchangeable A.B.C. Series of Gasfires, Patent Combined Gas-Air Adjuster and Governor, Air Pad Fire-Brick, &c., &c.

Dinas Powis Water Supply.—A parish meeting held at Dinas Powis on Monday last week decided to urge the Rural District Council to take action for securing for the southern and western portions of the parish a supply of water similar to that furnished to the eastern portion by the Cardiff Corporation.

Winding-Up of the Fraserburgh Gas Company.—At an extraordinary meeting recently held by the shareholders of the Fraserburgh Gas Company, Limited, a formal resolution was passed to wind up the Company as early as possible, the undertaking having been acquired by the Town Council, under an arbitration, for £27,856, including interest since the 30th of April. In submitting the necessary resolution, the Chairman (Colonel M'Connachie) said the price obtained by the Company for their business was perhaps, under the circumstances, fair and moderate to both parties concerned. The Council were getting a good going concern, sufficient for present requirements, fully equipped, and with a very reliable and trustworthy Manager (Mr. H. S. Ritchie); and if they were able to give the gas consumers the same service in the future as they had had in the past, no one would have any cause to grumble. He was sure the shareholders wished them success with the concern.

Paignton Water Supply.—At a Western District meeting of the Institution of Municipal and County Engineers on the 30th ult., Mr. J. C. Hawkins, in a paper on the "Paignton Water-Works," mentioned that for its water supply from Holne Moor, on Dartmoor, the Paignton District Council wisely followed the precedent set by Torquay, and purchased the drainage area, consisting of 740 acres of moorland, and 60 acres were fenced in to prevent direct pollution from cattle. The works were opened in 1907; the storage obtained being 190 million gallons, with a top-water area of 34 acres. The pipe-line of cast iron, 9 inches in diameter, is rather more than 16 miles long. In addition to Paignton, supplies are given to Ipplepen, Teignmouth, and Brixham. The Council last year obtained an Act giving them powers to duplicate the trunk main; the estimated cost of the works being £27,500. The three service reservoirs in Paignton have capacities of 600,000, 300,000, and 11,000,000 gallons respectively.

Porthcawl Water Scheme.—A Local Government Board inquiry has been held at Porthcawl, with reference to an application by the Urban District Council for sanction to borrow £10,500 for the purpose of augmenting the water supply, by providing filter-beds and a service reservoir at Tycoch, with the accompanying distributing mains. Some ratepayers who opposed suggested that, before the proposed scheme was undertaken, the existing compensation reservoir should be made water-tight. On behalf of the Council, it was pointed out that the present application represented the second stage of the scheme which they proposed in order to meet the water requirements of the district. They had already carried out the construction of a compensation reservoir at Craig-y-Aber, together with the provision of the distributing mains; but there were complaints of insufficient pressure to some of the high portions of the district, and these would be obviated by the present works. The service reservoir at Tycoch would have a capacity of 1,000,000 gallons.

Proposed Electricity Supply for Retford.—At the last monthly meeting of the Retford Town Council, the Mayor (Mr. T. H. Denman), in accordance with notice, moved for the appointment of a Committee to consider and report on the advisability or otherwise of obtaining a supply of electricity within the borough. Mr. Moss criticized the proposal in a long and temperate speech, in which he quoted the opinion expressed seven years ago by the late Mr. Jenkins, to the effect that an electricity undertaking in Retford would be a non-paying concern; and submitted that nothing had since occurred to induce the Council to depart from the policy they then decided upon not to entertain the project. In the result, the Mayor's motion was carried with two dissentients; and the Committee was formed.

The Griffin Gas-Stove Company, Limited, has been formed with a capital of £5000, in £1 shares.

The Porthcawl Gas Company have decided to remodel their works, and lay a larger main throughout the town.

Following upon the recent reports as to coal discoveries in Buckinghamshire, there has been registered a Company with the title of the Bucks Coalfields Syndicate, Limited, with a capital of £25,000.

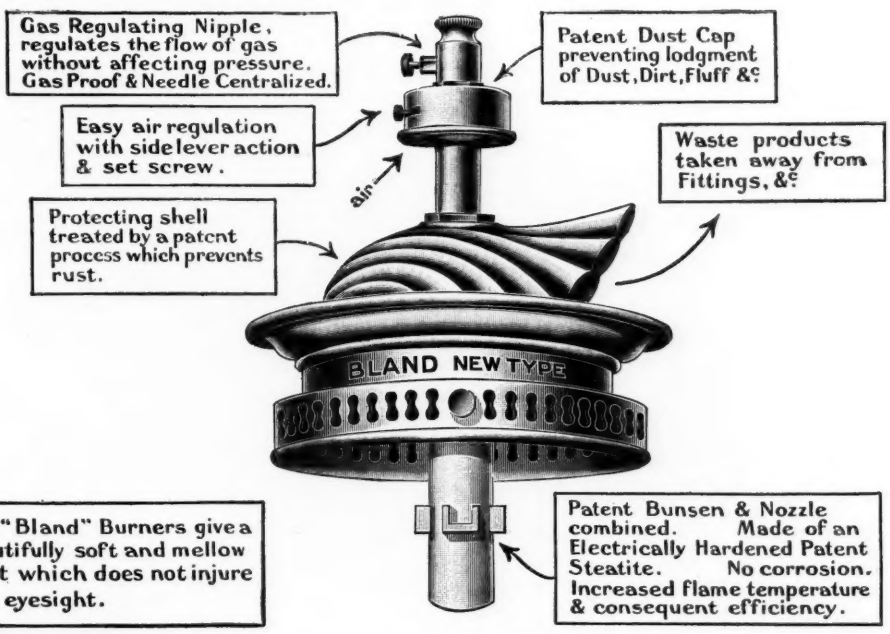
The Salford Corporation Gas Committee have decided to contribute a sum of £5 towards the expenses of the lectures arranged to be given at the Manchester University by the Manchester and District Junior Gas Association, supported by the Manchester District Institution of Gas Engineers.

The supply of water to Midhurst is sought to be improved by means of a loan of £1659; and last Wednesday a public inquiry was held on the matter by one of the Inspectors of the Local Government Board. Opinions differed as to the purity of the present supply obtained from the Cowdray Estate.

On the afternoon of Saturday week, through the courtesy of Mr. A. Yuill, the Engineer and Manager, a large party of the Institute of Engineers paid a visit to the Dundee Corporation Gas-Works. At the conclusion of the walk round, Mr. Yuill expressed his pleasure at seeing so large a party. A vote of thanks was accorded to Mr. Yuill, and to the gentlemen who had acted as guides.

We have received from Messrs. Falk, Stadelmann, and Co., of Farringdon Road, E.C., a copy of their new catalogue of gas-fittings. It consists of over 300 pages, and is excellently got up. The printing is in two colours, which constitutes a new departure for the firm; and specially large type is used for the identifying numbers and prices. The idea has been to produce a book which people engaged in gas distribution departments and others will be pleased to hand to customers. The list can be had in a leather cover, with the name of any particular gas authority on it, if desired. To the contents some reference is made elsewhere in this issue; and it need only be remarked here that they justify the title which has been bestowed upon the catalogue—"Art and Utility in Gas-Fittings."

This is the Burner.


Gas Regulating Nipple, regulates the flow of gas without affecting pressure. Gas Proof & Needle Centralized.
Patent Dust Cap preventing lodgment of Dust, Dirt, Fluff &c
Easy air regulation with side lever action & set screw.
Waste products taken away from Fittings, &c
air
Protecting shell treated by a patent process which prevents rust.
BLAND NEW TYPE
The "Bland" Burners give a beautifully soft and mellow light which does not injure the eyesight.
Patent Bunsen & Nozzle combined. Made of an Electrically Hardened Patent Steatite. No corrosion. Increased flame temperature & consequent efficiency.

BRITISH MADE THROUGHOUT.

New Catalogue of 112 Pages now Ready. The most comprehensive ever issued.

THE BLAND LIGHT SYNDICATE, LTD., 63, Queen Victoria St., LONDON, E.C., & 20, Fennel St., MANCHESTER.

The application of the meter inspectors, fitters, and yardmen employed at the Lytham Gas-Works for a week's holiday, with pay, each year, has been refused by the Council.

We have received from the Richmond Gas Stove and Meter Company, Limited, a new season's fire booklet, tastefully arranged, with an artistic cover in colours, entitled "Warmth and Comfort;" giving particulars of their "A.B.C." series and other gas-fires, &c.

The inhabitants of Westbourne (Sussex) are at present divided on the subject of obtaining a supply of water. The cost of an independent service has been estimated at £6400, though an offer has been made of a free site for the works; while the sum of £2000 would ensure a supply from the Portsmouth Water Company's mains at Emsworth. The greatest opposition to the local supply is that a system of drainage would follow, causing a great increase in the rates.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Oct. 7. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast, Liverpool.	West Coast, Manchester.	Glasgow.
Tar, crude	per ton	—	20/- 25/-	21/- 25/-	21/- 25/-	21/- 25/-	—
Pitch	„	42/6	40/- 40/6	40/-	40/6	39/6	40/-
Benzol, 90%	per gallon	1/0½	-/10	-/10½	-/10½ -/10¾	-/10¼	-/10½
Benzol, 50-90%	„	—	-/10	-/9	-/10½	-/10⅝	—
Toluol, 90%	„	—	-/10¼	-/9	-/11½	-/10½	-/10
Crude naphtha, 30%	„	—	-/4¼	-/4¼	-/4¼	-/4 -/4⅛	—
Light oil, 50%	„	—	-/3⅜	-/3¾	-/3⅜ -/4	-/3⅜	—
Solvent naphtha, 90-160	„	—	-/10¼	-/10	-/10	-/10	-/11
Heavy naphtha, 90-190	„	—	-/11	-/11	-/11½	-/11⅝	-/11
Creosote in bulk	„	-/2⅜ -/3	-/2¼	-/2¼	-/2⅛ -/2¼	-/2¼	-/2
Heavy oils	„	—	-/2⅛ -/2⅝	-/2¼	-/2⅝	-/2⅝ -/2¾	-/2¾
Carbolic acid, 60's	„	2/4	2/2	2/2	2/1	2/1	2/2
Naphthalene, crude drained salts	per ton	—	43/9	42/6	45/- 47/6	50/-	—
„ pressed	„	—	60/-	63/-	60/-	60/- 75/-	—
„ whizzed	„	—	—	—	70/- 72/6	65/- 75/-	62/6
Anthracene	per unit	-/2	-/1½	-/1½	-/1¼	-/1¼	—

N.B.—In the previous week's return, the price of London pitch was given in error as 40/-. It should have been 42/6.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S JOURNAL."

Appointments Vacant.

ENGINEER AND GAS MANAGER. Nottingham Corporation. Applications by Nov. 2.
DRAUGHTSMAN. West's Gas Improvement Company.
TRAVELLER. No. 5455.
RESIDENT FOREMAN. Beccles Gas Company.
GENERAL MANAGER (GAS ENGINEERING FIRM). No. 5458.

Appointments Wanted.

CHEMICAL PLUMBER. No. 5450, c/o Mr. King, 11, Bolt Court, Fleet Street, E.C.
INSTALLATION WORK. No. 5457.

Agency Wanted. No. 5456.

Plant, &c. (Second-Hand), for Sale.

METHANE-HYDROGEN WATER-GAS PLANT. Hythe Gas Works.

Patent Licence, &c.

ACETYLENE GAS GENERATORS. Haseltine, Lake, and Co., London.
SPIRAL GUIDE GASHOLDERS. W. Gadd, Manchester.

Meetings.

EUROPEAN GAS COMPANY. London Office. Oct. 17. 2.30 o'clock.
INSTITUTION OF GAS ENGINEERS' PUBLICITY AND GENERAL PURPOSES FUND. Institution of Mechanical Engineers. Oct. 12. Three o'clock.

Stocks and Shares.

DORKING GAS COMPANY. By Auction. Oct. 17.
TENDRING HUNDRED WATER COMPANY. Oct. 17.
WOKING DISTRICT GAS COMPANY. By Auction. Oct. 31. Two o'clock.

Stocks and Shares (*continued*).

WOKING WATER AND GAS COMPANY. By Auction Oct. 17.
WORTHING GASLIGHT AND COKE COMPANY. By Auction. Oct. 17.

TENDERS FOR

Benzol (Crude).

BRIDGEWATER COLLIERIES COKE WORKS. Tenders by Oct. 18.

Gasholder, &c.

BELFAST GAS DEPARTMENT. Tenders by Oct. 20.

Main Laying, &c.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. Tenders by Oct. 30.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 92.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	81—84	..	5 19 1	200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	118—120	..	5 0 0
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	93—95	..	4 4 3	561,000	Stk.	Aug. 16	10	Liverpool United A. .	215—217	+1	4 12 2
250,000	5	Sept. 28	7	Bombay, Ltd. . . .	6—6¼*	..	5 7 8	718,100	„	„	7	Do. B. .	163—165	..	4 4 10
50,000	10	Aug. 31	15	Bourne-) 10 p.c. . .	23½—23½	..	5 1 8	306,083	„	June 30	4	Do. Deb. Stk.	102—104	..	3 16 11
311,810	10	„	7	mouth Gas) B 7 p.c. .	16¾—16¾	..	4 3 7	75,000	5	June 15	6	Malta & Mediterranean	4⅜—5	..	6 0 0
75,000	10	„	6	and Water) Pref. 6 p.c.	14¼—14¼	..	4 1 4	560,000	100	Oct. 2	5	Met. of) 5 p.c. Deb.	100—102*	+1½	4 18 0
380,000	Stk.	Aug. 16	13	Brentford Consolidated	256—261	..	4 19 7	250,000	100	„	4½	Melbourne) 4½ p.c.Deb.	100—102*	+1	4 8 3
330,000	„	„	10	Do. New . . .	198—203	..	4 18 6	541,920	20	May 31	3½	Monte Video, Ltd. . .	12⅜—13	−⅛	5 7 8
50,000	„	„	5	Do. 5 p.c. Pref. .	120—122	..	4 2 0	1,775,892	Stk.	July 28	4⅜	Newc'tle&G'tesh'd Con.	103—104	−⅜	4 4 2
206,250	„	June 15	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10	529,705	Stk.	June 30	3½	Do. 3½ p.c. Deb.	87—89	..	3 18 8
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	216—221	..	4 19 7	55,940	10	Aug. 31	7/7/0	North Middlesex 7 p.c.	14½—15½	..	4 10 4
246,320	„	„	8	Do. A Ord. Stk. .	156—159	..	5 0 8	300,000	Stk.	Apl. 27	8	Oriental, Ltd. . . .	138—140	..	5 14 4
490,000	20	Sept. 28	12½	British	44½—45½*	..	5 9 11	60,000	5	Sept. 28	8	Ottoman, Ltd. . . .	6½—7*	..	5 14 4
120,000	Stk.	June 30	4	Do. 4 p.c. Deb. Stk.	94—96	..	4 3 4	31,800	53	Aug. 16	13	Portsea Island A . .	135—139	+3	4 19 0
109,000	„	Aug. 16	6	Bromley, A 5 p.c. . .	115—120	..	5 0 0	60,000	50	„	13	Do. B . .	124—128	+2½	5 1 7
165,700	„	„	4½	Do. B 3½ p.c. . .	89—91	+2½	4 18 11	100,000	50	„	12	Do. C . .	121—125	+3½	4 16 0
82,278	„	„	5½	Do. C 5 p.c. . .	105—110	..	5 0 0	398,490	5	May 31	8	Primitiva Ord. . . .	7⅞—7⅞	..	5 4 11
55,000	„	June 30	3½	Do. 3½ p.c. Deb. .	82—84	..	4 3 4	796,980	5	June 30	5	Do. 5 p.c. Pref. .	5 15/16—5 7/8	..	4 11 11
250,000	Stk.	„	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6	488,900	100	June 1	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—	312,650	Stk.	June 30	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Do. 4½ p.c. Pref. .	4—5	..	—	250,000	5	Sept. 28	12	San Paulo, Ltd. . . .	10½—11*	..	5 9 1
100,000	Stk.	June 30	4½	Do. 4½ p.c. Deb.Stk.	80—83	..	5 8 5	115,000	10	„	6	Do. 6 p.c. Pref. .	11¼—12½*	..	4 18 0
157,150	Stk.	Aug. 16	5	Chester 5 p.c. Ord. . .	107—109	..	4 11 9	125,000	50	July 1	5	Do. 5 p.c. Deb. .	50—51	..	4 18 0
1,513,280	Stk.	„	5/9/4	Commercial 4 p.c. Stk.	111—113	..	4 16 8	135,000	Stk.	Aug. 31	10	Sheffield A	237—239	..	4 3 8
560,000	„	„	5½	Do. 3½ p.c. do..	105—107	..	4 19 8	209,984	„	„	10	Do. B	237—239	..	4 3 8
475,000	„	June 15	3	Do. 3p.c. Deb. Stk.	76—78	..	3 16 11	523,500	„	„	10	Do. C	235—237	..	4 4 5
800,000	Stk.	May 31	4	Continental Union, Ltd.	85—88	−1½	4 10 11	90,000	10	Sept. 28	6	South African . . .	8—9*	..	6 13 4
200,000	„	„	7	Do. 7 p.c. Pref.	135—137	..	5 2 2	6,429,895	Stk.	Aug. 16	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122—124	..	4 8 9	1,895,445	„	July 14	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
55,000	„	—	4	Do. Deb. Stk. . . .	104—105	..	3 16 2	209,820	Stk.	Aug. 16	8½	South Shields Con. Stk.	152—154	+2	5 10 5
840,150	10	July 28	10	European, Ltd. . . .	18½—19½	..	5 2 7	605,000	Stk.	„	5⅝	S'th Suburb'n Ord. 5 p.c.	118—120	+½	4 14 4
16,16),600	Stk.	Aug. 16	4/14/8	Gas-) 4 p.c. Ord. . .	104½—105½	−1	4 9 9	60,000	„	„	5	Do. 5 p.c. Pref. .	115½—117½	..	4 5 1
2,600,000	„	„	3½	light) 3½ p.c. max. .	84—86	+1	4 1 5	117,058	„	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
4,062,235	„	„	4	and) 4 p.c. Con. Pref.	102—104	+1	3 16 11	502,310	Stk.	May 12	5	Southampton Ord. . .	108—110	..	4 10 11
4,531,705	„	June 15	3	Coke) 3 p.c. Con. Deb.	80—82	..	3 13 2	120,000	Stk.	Aug. 16	7½	Tottenham) A 5 p.c. .	145—148	..	4 16 3
258,740	Stk.	Sept. 14	5	Hastings & St. L. 3½ p.c.	94—96	..	5 4 2	483,940	„	„	5⅝	and) B 3½ p.c. .	115—117	..	4 16 1
82,500	„	„	6½	Do. do. 5 p.c.	—	..	—	149,470	„	June 15	4	Edmonton) 4 p.c. Deb.	96—98	..	4 1 8
70,000	10	Apl. 27	11	Hongkong & China, Ltd.	17⅛—18	..	6 2 2	182,380	10	June 15	8	Tuscan, Ltd.	8⅝—9½	..	8 13 0
131,000	Stk.	Sept. 14	7½	Ilford A and C . . .	150—153	..	4 18 0	149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
65,780	„	„	6	Do. B	120—123	..	4 17 7	236,476	Stk.	Aug. 16	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
65,500	„	June 30	4	Do. 4 p.c. Deb. . . .	94—96	..	4 3 4	255,636	Stk.	Aug. 31	6¾	Wands-) B 3½ p.c. . .	142—145	..	4 14 10
4,940,000	Stk.	May 12	9	Imperial Continental .	181—184	..	4 17 10	85,766	„	June 30	3	worth) 3 p.c. Deb.Stk.	71—73	..	4 2 2
1,235,000	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.	90—92	..	3 16 1								

Prices marked * are "Ex. div."

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, LONDON, E.C. "Volcanism, London."

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works, BRADFORD,
MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Oct. 3, p. 9.

ENQUIRIES SOLICITED.

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS,
C. & W. WALKER, LIMITED,
DONNINGTON, NEWPORT, SALOP.

HIGH PRESSURE GAS.

COMPLETE LIGHTING INSTALLATIONS supplied by
JAMES MILNE AND SON, LIMITED,
EDINBURGH, GLASGOW, LONDON, LEEDS.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
JOHN RADCLIFFE, Chemical Engineer, EAST BARNET.

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d. "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 248 Holborn.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

OXIDE OF IRON (BOG ORE)
ANY QUANTITY. ANY PORT. ANY STATION.
DONALD M'INTOSH,
110, CANNON STREET, LONDON.

DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
W. T. P. CUNNINGHAM,
13, Arcadian Gardens, Wood Green, LONDON, N.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

COAL TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

The Institution OF Gas Engineers.

PUBLICITY

& SPECIAL PURPOSES FUND.

As already announced, a Meeting of the Supporters of the above will be held on

THURSDAY, 12th OCTOBER, 1911,

AT THE

INSTITUTION OF MECHANICAL ENGINEERS,

STOREY'S GATE, ST. JAMES' PARK, WESTMINSTER,

to constitute the Association for administering the Fund, and to transact other business incidental thereto.

The Chair will be taken at 3 p.m. by the President of the Institution, Robt. G. Shadbolt, Esq.

All interested in the matter are invited to attend. Tickets of admission may be obtained from
WALTER T. DUNN,
Secretary.
39, Victoria Street,
Westminster, S.W.

OXIDE OF IRON.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
"KLEENOFF," THE COOKER CLEANER.
BALE & CHURCH, LTD.,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 1588 AVENUE (3 lines).

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

PRESSURE REDUCERS.
ACTION—SIMPLE, AUTOMATIC, FRICTIONLESS.
THE THING for your Hilly Districts.
Write to-day for illustrated Sheet—
JAMES MILNE AND SON, LIMITED,
EDINBURGH, LONDON, GLASGOW, LEEDS.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, SUNDERLAND, and WAKEFIELD.

SULPHURIC ACID — Specially prepared for Sulphate of AMMONIA and BENZOL Recovery Plants. JOHN NICHOLSON & SONS, LTD., Hunslet Chemical Works, LEEDS. Tele.: "NICHOLSON, LEEDS." Telephone: (Two lines), Nos. 2420 and 2421.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

PATENTS for Inventions. British, Colonial, and Foreign. Moderate and inclusive fees. Advice free. Trade Marks and Designs Registered. Our "GUIDE TO PATENTS" should be read and retained by all interested. Copy free on application to WITHERS & SPOONER, Chartered Patent Agents, 323, High Holborn, LONDON. Estab. 27 years.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, ROSE MOUNT IRON-WORKS, ELLAND.

FOR SALE.

LEAK TEST,
The Best on the Market
(*a*) for High Pressure Main;
(*b*) for High Pressure Service.
Full particulars from
JAMES MILNE AND SON, LIMITED,
EDINBURGH, LONDON, GLASGOW, LEEDS.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: "SATURATORS, BOLTON." Telephone 0848.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

TAR WANTED.

THE Burnden Tar Company (Bolton), Limited.
Hulton Chemical Works, BOLTON.

FOR Instructions on Polishing and Cleaning Gas-Cookers and Gas-Fittings, read Canning Handbook on Polishing, Electro-Plating, and Lacquering. Fully illustrated. Price 2s. 3d., post free; abroad, 2s. 6d.
W. CANNING AND CO., BIRMINGHAM, and 18 to 20, St. John's Square, Clerkenwell, LONDON, E.C.

CITY and Guilds. Mr. Cranfield's Correspondence Classes are about to resume. Instruction private, individual, and thorough. Courses and results better than ever.
Address, 11, Avondale Place, HALIFAX.

CITY & Guilds. Records. Over 200 passes and 8 medals during the past Five years, in Gas Engineering. Classes for 1912 Exams. now working. Illustrated Lectures. Low Fees. Write for our new Gas Engineering Kalendar, post free.
CORRESPONDENCE COLLEGE CO., Dept. B, KING'S LYNN.

CHEMICAL Plumber and Leadburner, Thoroughly Practical in all branches and the Erection of Towers, Chambers, Tanks, Acids, and Sulphate of Ammonia Plants. Can Take Charge. References from Leading Firms. (Any distance).
Address No. 5450, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

REPRESENTATIVE, with Extensive Connection, and well known in the Gas Industry, desires additional AGENCY to work jointly with Fittings.
Address No. 5456, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Competent young man (Age 25 and married) seeks permanent situation in Gas Company; well up in Fixing Low and High Pressure Installations, Gas-Engines, &c. Able to Take Charge.
Address, No. 5457, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A YOUNG Man of good address, with knowledge of Gas-Works Plant, &c., required to TRAVEL in Scotland and Ireland for a Firm of Manufacturers of Gas-Works Apparatus.
Apply, stating fully Age, Experience, and Salary expected, to No. 5455, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A BIG profit for Agents.—Agents wanted to make good money selling "Frugals"—the wonderful gas-savers. Every private and business house needs them; liberal Profits. Write at once for Terms and Particulars. LEFTWICH & Co., Gas Lighting. Dept., 34, James Street, Camden Town, LONDON, N.W.

WANTED, for a Large Gas Engineering Firm in the North, a capable, energetic, up-to-date GENERAL MANAGER. He must be Conversant with the Manufacture and Erection of General Gas Plant and Constructional Ironwork in all its Branches (except Gasholders), and be qualified to take General Administrative Management.
Apply, by letter, stating Age and Experience (which will be treated confidentially), also Salary expected, which will be subject to increment if Applicant proves satisfactory, to No. 5458, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Beccles Gas Company require a RESIDENT WORKS FOREMAN. Age about 30 years. Must be a good Carbonizer and used to Sulphate Plant.
House, Fuel, Garden, and Gas free.
Further Particulars may be obtained on Application to the MANAGER, Gas Company, BECCLES.

FOR SALE.—Methane-Hydrogen WATER-GAS PLANT, fitted for use of Oil. 50,000 Cubic Feet per day capacity, to be replaced by a larger plant of same make. Can be seen at work.
Price and Particulars from the MANAGER, Gas-Works, Hythe, Kent.

CITY OF BELFAST.

THE Gas Committee of the Belfast Corporation invite TENDERS for the Erection of a SPIRAL GUIDED GASHOLDER of 3 Million Cubic Feet capacity, and other Works in connection therewith.
The Drawings and Specification may be obtained from Mr. J. D. Smith, Engineer and Manager, Gas-Works, on payment of a fee of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender.
Tenders, endorsed "Tender for Gasholder," should be lodged in the office of the undersigned not later than noon on Oct. 20, 1911.
Parties Tendering must comply with the Council's Standing Order relating to payment of Wages, &c.
The lowest or any Tender not necessarily accepted.
R. MEYER,
Town Clerk.

BRIDGEWATER COLLIERIES COKE WORKS.
(THE EARL OF ELLESMERE.)

TENDERS are invited for a quantity of about 12,000 to 14,000 gallons per Month of CRUDE BENZOL, testing 80 per cent. at 120° C., during the Six or Twelve Months commencing Nov. 1, 1911, Delivered into Contractor's Tanks at the Bridgewater Collieries, Wharton Hall Siding (Pendleton and Hindley Branch), L. and Y. Ry.; or at Brackley Siding (Little Hulton Mineral Branch), L. and N. W. Ry.
Tenders, endorsed "Tender for Crude Benzol," to be received at the BRIDGEWATER COAL OFFICES, 4, Chapel Walks, MANCHESTER, not later than the 18th of October, 1911.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

TENDERS are invited for the Laying of GAS MAINS in various districts.
Form of Tender, &c., on Application, and route plans Inspected at the CHIEF OFFICE of the Company, Victoria Road, ALDERSHOT.
Tenders, to be delivered by Nine a.m. on Monday, Oct. 30, 1911, addressed to the General Manager, and endorsed "Tender for Gas Mains (Excavations, &c.)."

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
WOKING WATER AND GAS COMPANY.
NEW ISSUE OF £3000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 17, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, as above.

By order of the Directors of the
WORTHING GASLIGHT AND COKE COMPANY.
NEW ISSUE OF £3500 CONSOLIDATED ORDINARY STOCK.
AND
£1500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 17, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, as above.

TENDRING HUNDRED WATER COMPANY.
105 £10 "A" AND "B" SHARES.

DORKING GAS COMPANY.
TEN £25 "A," AND "B," SHARES,
AND
£34 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 17, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
WOKING DISTRICT GAS COMPANY, LIMITED.
NEW ISSUE OF 1000 £5 FIVE PER CENT. PREFERENCE SHARES.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 31, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

THE Proprietor of Patent No. 24,463 of 1907, for "IMPROVEMENTS IN ACETYLENE GAS GENERATORS, is desirous of entering into Arrangements, by way of LICENCE and otherwise, on Reasonable Terms, for the purpose of EXPLOITING the same and ensuring its Full Development and Practical Working in this Country. All Communications should be addressed in the first instance to HASELTINE, LAKE, & Co., Chartered Patent Agents and Consulting Engineers, 7 & 8, Southampton Buildings, Chancery Lane, LONDON, W.C.

JUST PUBLISHED. BOUND IN CLOTH. 150 PAGES. 40 ILLUSTRATIONS.
Price 2s. 6d., Post Free.

PRACTICAL ADVICE ON GAS-FITTING,

By R. HALKETT,

Assistant Superintendent, City of Leeds Gas Mains and Distribution Department.

The work is the outcome of a number of years' practical training and experience on part of the author, and is an invaluable book for all engaged in the Fitting branch of the Gas Industry.

WALTER KING, "JOURNAL" OFFICES, 11, BOLT COURT, FLEET STREET, LONDON, E.C.